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PROCEEDINGS
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I

PRELIMINARY DIAGNOSES OF FOUR NEW SNAKES FROM LOWER CALIFORNIA, MEXICO

BY
JOHN VAN DENBURGH, *Curator*
AND
JOSEPH R. SLEVIN, *Assistant Curator*
Department of Herpetology

This paper is based upon material secured during a recent visit to the Todos Santos Islands and the San Pedro Martir Mountains. One of the chief objects of this expedition was the securing of more information regarding the garter-snakes of the San Pedro Martir Mountains, the status of which had never been satisfactorily settled. The material now at hand makes necessary the description of these garter-snakes as a distinct subspecies. The discovery of the other new snakes was quite unexpected. The presence of a king snake on South Todos Santos Island is most interesting in its zoogeographical aspects.

1. **Diadophis anthonyi,** new species

Diagnosis.—Similar to *D. amabilis amabilis* but with collar obsolete and edges less definite; gastrosteges heavily marked with complete or interrupted transverse black bars, instead of more or less numerous black spots. Scales in 15 rows. Gastrosteges 180 to 192; urosteges 64. Supralabials 7-7; infralabials 8-8.

Type: Adult male, No. 56766, Mus. Calif. Acad. Sci., collected May 30, 1923, by Joseph R. Slevin on **South Todos Santos Island, Lower California, Mexico**; two *paratypes,* Nos. 56764 and 56765 from same locality.

2. **Lampropeltis herreræ,** new species

Diagnosis.—Similar to *L. zonata* but with the red of that species represented only by a few small lateral blotches or spots of very pale pink usually evident only on the neck; snout black. Scale rows 23. Gastrosteges 217 to 220; urosteges 52 to 59. White rings on body 36 to 41; on tail, 8 to 10.

Type: Adult male, No. 56755, Mus. Calif. Acad. Sci., collected May 25, 1923, by Joseph R. Slevin on **South Todos Santos Island, Lower California, Mexico**; eight *paratypes,* Nos. 56756 to 56763 from same locality.

3. **Lampropeltis agalma,** new species

Diagnosis.—Similar to *L. zonata* but with upper surface of snout largely red instead of black. Scale rows 23. Gastrosteges 207 to 213; urosteges 52 to 56. White rings on body 40 to 45; on tail, 8 to 10.

Type: Adult male, No. 56856, Mus. Calif. Acad. Sci., collected June 16, 1923, by Joseph R. Slevin at about 7,000 feet altitude near **Alcatraz, San Pedro Martir Mountains, Lower California, Mexico**; one *paratype,* No. 56879, from Valladares Creek, San Pedro Martir Mountains, Lower California, Mexico.

4. **Thamnophis ordinoides hueyi,** new subspecies

Diagnosis.—Similar to *T. o. vagrans* but with dorsal spots and dark gastrostege markings usually less evident and gastrosteges fewer. Scale rows 21-19-17. Gastrosteges 151 to 161; urosteges 66 to 82. Supralabials usually 8-8; infralabials normally 10-10; preoculars 1-1. Dorsal line complete, its borders often invaded by more or less evident dorsal spots; anterior edges of gastrosteges with more or less concealed dark pigmentation.

Type: Adult female, No. 56855, Mus. Calif. Acad. Sci., collected June 13, 1923, by Joseph R. Slevin at about 7,300 feet altitude near **Arroyo Encantada, between La Grulla and La Encantada, San Pedro Martir Mountains, Lower California, Mexico**; ten *paratypes,* Nos. 56852 to 56854 and 56856 to 56862 from same locality.

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VOL. XIII, No. 2, pp. 3–4 JULY 26, 1923

II

A NEW SUBSPECIES OF WATERSNAKE *(Natrix vibakari ruthveni)* FROM EASTERN ASIA

BY

JOHN VAN DENBURGH

Curator, Department of Herpetology

Anyone who examines the table of scale-counts of specimens of *Natrix vibakari* given by Dr. Stejneger in his Herpetology of Japan and Adjacent Territory (p. 270) must be struck by the fact that specimens from the Asiatic mainland have fewer urosteges than those from the islands of Japan. The same difference is shown by the series in the collection of the California Academy of Sciences.

In *Natrix tigrina,* from the same regions, a similar difference in the number of urosteges in the mainland and island specimens has been found and is recognized in nomenclature, the island form being called *Natrix tigrina tigrina* and the mainland one *Natrix tigrina lateralis.*

No good reason is evident why these differences should be recognized in one instance and not in the other, and, since the island form of *Natrix vibakari* served as the basis of the original description, I now propose that that form be known as *Natrix vibakari vibakari* while those from the mainland are called

Natrix vibakari ruthveni Van Denburgh, new subspecies

Diagnosis: Similar to *Natrix vibakari vibakari* but usually with fewer urosteges (55 to 65 instead of 63 to 83).

Type: An adult male, No. 31,487, Mus. Calif. Acad. Sci., collected at **Fusan, Kjong-Sang-Do Province, Korea,** May 8, 1911.

Remarks: These subspecies seem to differ in no important respect other than in the number of urosteges. These plates average 71.4 in thirty-four specimens of *Natrix vibakari vibakari* from Japan, while the average in nine specimens of *Natrix vibakari ruthveni* from Korea and Siberia is only 61. There seems not to be much sexual difference in the number of urosteges in either subspecies, since in *N. v. vibakari* the averages are 74 in fourteen males and 71 in twelve females, while in *N. v. ruthveni* the counts in three males average 61 and in four females, 60.

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Vol. XIII, No. 3, pp. 7-28 September 13, 1923

III

FURTHER NOTES ON THE BIRDS AND MAMMALS OF SISKIYOU COUNTY, CALIFORNIA

BY

JOSEPH MAILLIARD

Curator, Department of Ornithology and Mammalogy

In the spring of 1920 a field party from the Department of Ornithology and Mammalogy, of the California Academy of Sciences, made a partial survey of portions of Siskiyou County, California (Mailliard, Proc. Calif. Acad. Sci., 4th Ser., Vol. 11, No. 5, pp. 73-94). This survey was again taken up in 1922, and carried on from May 13 to June 28, inclusive.

The party consisted of Mr. Herbert Barth, of San Francisco, California, and the writer, and was equipped with an automobile and full camping outfit.

The main object of the work was to ascertain definitely whether any birds of the genus Passerella (fox sparrows) were nesting in the mountains west of Shasta Valley, or in the Salmon Range still farther west, and, if so, to what race they belonged. These mountains appeared to afford ideal breeding grounds for this genus, but during the Academy's survey of 1920 no breeding birds were taken, nor had fox sparrows ever been recorded from there.

In addition, it was desired to determine whether the Olive-backed Thrush *(Hylocichla ustulata swainsoni)* is a stray, a migrant, or a regular breeder in Siskiyou County. The making of further observations upon the Gray Flycatcher *(Empidonax griseus)* was also an object.

Weed, our first stopping place in Siskiyou County, was reached early in the afternoon of May 13, and camp was established at the edge of a meadow about a mile south of the town.

The oaks and willows were but just budding out at the time, as the spring had been a cold, late one, and there had been a fall of snow only a few days before our arrival.

This camp at Weed seemed to be in a most promising looking place for finding bird life plentiful, and, as the meadow contained quite a growth of willow, it was reasonable to expect to find numbers of thrushes there. In both these respects we were disappointed, for birds proved to be very scarce, while no thrushes appeared at all, although they had been numerous at Weed at the same date in 1920. In that year this meadow was the breeding ground of a good many Modoc Song Sparrows *(Melospiza melodia fisherella),* but on this second occasion not one of these birds was seen anywhere in the vicinity.

On May 14 the nest of a Sierra Junco *(Junco oreganus thurberi)* was found with fresh eggs, one of which was on the ground outside the nest. This egg was returned to its proper place and the next day the bird was found sitting on her nest.

Mouse and rat traps were set each night at this camp, but the returns from them were very meager, and consisted of only common species of Peromyscus. Extra attention was paid to meadow mice (Microtus), but not a sign of one was found in the meadow.

Nothing new was added to the list of birds noted on the visit of two years before.

It was not the intention to remain long in this vicinity, as Bray seemed to be better adapted to our needs, judging from previous experience, but before going there a side trip was made to Big Springs, about 18 miles north of Weed. This visit was made principally to ascertain if there were any land or freshwater snails there, and also to find out if the singular association of juniper, sage, and lava, extending over many square miles in that vicinity was attractive to other than the usual species of birds found in this county.

Big Springs, or Mayten, is situated at an altitude of something less than 3000 feet. In the lagoon formed by the artificial damming of the flow from the large springs no fish have ever been noted, and it has been generally supposed that there were no mollusks; but fish were seen not far below the dam in the stream flowing from it, and we found a few shells of three species of mollusks in a shallow part of the lagoon, which at no point is very deep. We came to the conclusion that shells were very scarce, however, for three hours' work brought to light only about 30 specimens, all told. Shells may be more numerous in other parts of the lake, but that is improbable, as several different places were examined without results.

Much to our disappointment we found, in this vicinity, only the common birds one would expect to find in the average locality of like altitude in this part of the state, and there was nothing of any especial interest in the juniper forest.

Traps were set for mice, with practically no results.

Big Springs was visited by the Alexander Expedition of 1911, early in June, but the outlook was so unpromising that only a short stay was made there (Univ. Calif. Publ., Zool., Vol. 12, Nos. 12-13).

On May 18 camp was shifted to Bray, which is about 36 miles northeast of Weed and some 20 miles from Mt. Shasta, with the intention of remaining there some days. From Weed to Bray the only route that was passable at that time was the Deer Mountain road—reaching an altitude of over 6000 feet where it crosses the summit of the range—from which the snow had but lately melted. Although much of the country on either side of the road appeared to be suited to some species of birds, hardly any were seen on the journey.

The weather had changed from unseasonable heat, with thunderstorms, to cold and threatening weather. Advantage was taken of the fact that the cabin occupied two years previously by the Academy party was vacant, and it was promptly reoccupied by ourselves. Before moving in, however, a search was made, within a radius of several miles, for a more promising camping and collecting ground, but none was found.

May 19 was cold and windy, with rain in the evening, and birds were very scarce. No thrushes were seen or heard, apparently none having yet arrived at this altitude (4700 feet). The cabin occupied by us is situated on the edge of a mountain meadow through which Butte Creek runs. This meadow varied from, say, 200 to 400 yards in width, and extended down the stream for over a mile, having some thick patches of willow and cottonwoods in places, which were ideal for thrushes.

This year, however, there had been so great a snowfall in the mountains that the meadow was too much flooded to permit us to get about satisfactorily in it; and besides, the high water prevented us from crossing a number of little streams, which was a serious handicap to our prospective work there.

I had planned to make a study of thrushes in the willows and cottonwoods at Bray, but was prevented from doing so by these conditions, and no other good thrush habitat was discovered in the vicinity. There were clumps of willows here and there, but those examined did not seem to be just suited to the needs of the thrush family, as no members of it were discovered in any of them. Later on several of these birds were noted among the cottonwoods, working up the creek that runs through the long meadow just mentioned, and sometimes a few notes of the thrush were heard, but this genus was very scarce at Bray in this particular season.

May 20 was cold and rainy, with snow falling at slightly higher altitudes, and but few birds of any kind were seen. A pair of Ospreys *(Pandion haliaëtus carolinensis)* were seen hovering over the meadow, and occasionally catching one of the black bass that came downstream from Lake Orr, only a mile or so away. These bass either were suffering from some disease or were injured in a cascade on their way down, as they were usually in a dying condition when they reached the meadow, where they were eagerly sought by Turkey Vultures *(Cathartes aura septentrionalis)* and Ospreys, as well as by predatory mammals.

On the visit of two years ago the Ospreys were nesting above the meadow, but this season they must have had a nest somewhere downstream, for they were seen every day carrying fish in that direction.

Two gulls, apparently a pair, were also noted on the lookout for these dying or dead bass. From field glass examination at some little distance they appeared to be the California Gull *(Larus californicus),* and they were most probably on their way to one of the interior lakes to the northward, where this species is known to nest.

Visits were made to various localities within easy reach with the car from this camp, the first being made to Orr Lake. No birds of consequence were seen there on this occasion, but a lot of freshwater shells were obtained in the hope that something of interest in this line might be developed. It has since been determined, however, that the shells found there were of widely distributed species.

About May 22 the weather became warm and pleasant, and the next day we took a trip to the sagebrush plain near McDoel, about 14 miles north of Bray. Here a few Sage Thrashers *(Oreoscoptes montanus)* were seen or heard, together with some Western Vesper Sparrows *(Poœcetes gramineus confinis)* and Brewer's Sparrows *(Spizella breweri)*, but nothing else of note. Close examination of the sand under the sagebrush failed to show any signs of rodents, nor were there any small holes in the ground that appeared to be occupied by anything but lizards or toads, so that the idea of going there to trap for rats or mice was abandoned.

On the way back from McDoel two nests of the Mountain Bluebird were taken, both with sets of fresh eggs. The nests were between the stringers of railroad crossings, where the automobile road was cut through a fill. These passes were concreted on the sides and bridged over for the railroad track. The nests were composed of astonishingly large masses of straws and trash, carried in between the heavy stringers on the top of the concrete wall, and almost filling up the space between them, while the nest proper was some distance in and was only about three inches in diameter and two inches deep, inside measurement.

The first nest was found when the female flew off it as our car passed through the cut on our way out from camp. This nest was about nine feet above the bottom of the cut, and it was rather surprising that the slight noise made by the car should have flushed the bird, when heavy trains frequently passed only two or three feet overhead. It also happened on our return that a gang of railroad men were engaged in weeding the right-of-way, hoeing and shoveling directly over the nest, and yet the female was sitting when we investigated it.

The second nest found was about 12 feet above the road bed, and the owner remained on it until we disturbed her when examining the nest to see if it were occupied. Both these nesting places had been used before, to judge by the accumulation of old straw and rubbish upon which they were placed.

On the day that these nests were found (May 23) a Northern White-headed Woodpecker *(Xenopicus albolarvatus albolarvatus)*, a species new to our list of the birds of this locality, was seen near Keg, a railroad station about three miles north of Bray and at a little lower elevation.

May 24 was windy all day, clouding up and raining in the evening. That day, however, several thrushes were noted working upstream along the edge of the meadow. Three of these were secured for examination as to subspecies, with the hope that one or more might prove to be the Olive-backed Thrush *(Hylocichla ustulata swainsoni)*, but they could only be included with the Russet-backed *(H. u. ustulata)*. This date was the first on which any thrushes were heard singing.

It rained hard in the evening with a south wind, but in the night the wind shifted to the north and at daylight next morning everything was covered with a beautiful mantle of snow. The wind, however, shifted back to the south again about seven in the morning, and by night the snow had nearly all disappeared.

Several pairs of Mallards *(Anas platyrhynchos)* were breeding among the willows at the edge of the meadow, and one of the nests, with twelve eggs, was found by Barth on May 26. This nest was not disturbed at the time, but was found destroyed a few days later, when the eggs were within a day or two of hatching. This was probably the work of a coyote which we had heard in the vicinity about that time. Apparently the sitting bird was killed and eaten.

As time passed birds seemed to be becoming scarcer, rather than increasing in numbers, in the vicinity of Bray. A scattered few of the commonest birds, such as jays and robins, were nesting around, but species of special interest were very poorly represented. One of the objects of the visit to Bray was to note the proportion of Gray Flycatchers *(Empidonax griseus)* to the other species of the genus, and to take notes on its nesting. There were so few individuals at Bray this season, however, that it seemed to be a waste of time to wait there in the probably vain hope that more might come in. Scattered here and there one might see or hear a member of the Empidonax group, but these were all inordinately wild and hard to approach this season, for some unknown reason. During our stay of 19 days at Bray, but two Gray Flycatchers and one Hammond's Flycatcher *(Empidonax hammondi)* were secured, and no other representative of this genus was taken there or on any of our side trips around the neighborhood.

On May 26, the day after the snowfall, a Townsend's Solitaire *(Myadestes townsendi)* was secured, which proved new to our local list; and another addition, on May 28, was a Macgillivray's Warbler *(Oporornis tolmiei)*.

In the morning of May 29 we went out about 15 miles toward Red Rock Valley, in a northeasterly direction from Bray, and saw a couple of Prong-horn Antelopes *(Antilocapra americana americana)* feeding in the sagebrush near Tecnor (postoffice), but they were traveling away from us and were too far off to be caught with the camera. Some effort is made to protect the herd to which this pair belongs, but it is a wild country there, and lawless characters are quite numerous at times. The result is that the herd leads rather a precarious existence, although hay is doled out to it during very severe weather.

One determined, interested warden, stationed throughout the fall and winter at Bray, or Tecnor, could accomplish much in the way of conserving the antelopes and deer of that vicinity, but, as it is, the warden in Yreka has this large area in charge, besides his own, and seldom reaches this locality after the snow commences to fly in earnest.

A visit was made to Butte Lake on May 30. The lake was very full of water, but a lot of shells were found along the edge, which proved to be of common, widely distributed forms.

The sage plain between McDoel and Mt. Hebron (this latter place being a tumbledown little hamlet right out in the sandy sagebrush, miles from a mountain) was searched on the way for nests of the Sage Thrasher, but without much success from an oölogical standpoint. Several old nests were found, and one or two that seemed to be new, but neither eggs or young were found in any of them.

On May 31 we went to Tecnor again to look for Sage Grouse, but did not see a sign of any. It was reported that sheepmen had been in there a great deal of late, and that while their sheep destroyed a good many nests, the sheep herders attended to the destruction of the birds. Anyway, these birds seemed to be very scarce in this region, where they were formerly very abundant.

On our visit to this locality two days before, we had come across a small flock of Piñon Jays *(Cyanocephalus cyanocephalus)* in a part of the national forest that had not yet been touched, and found that this band consisted of several families of old and young. The latter were being fed principally upon the soft, fat pupæ of a Cicada which must have existed in numbers in the foliage of the yellow pines there, to judge from actions of the birds. Mouths and throats of old and young secured by us were crammed with these insects. The stomachs of these birds were saved, together with several of the insects taken from the birds' mouths, and sent to the U. S. Biological Survey for the identification of the various insects that were being used for food by these birds at the time. While passing through this same strip of forest on the second visit to Tecnor, some more of these birds were seen and heard.

The song of the Russet-backed Thrush was heard again on the evening of May 31, for the first time since the snow of the 26th instant.

On June 1 a visit was made to an old sawmill on Antelope Creek, a few miles away, the vicinity of which appeared to be an ideal place for birds. Here we found plenty of water, a variety of association, some open land, willows, sagebrush, large and small pines, various bushes, but very few birds. One matter of interest, however, was the presence of the White-crowned Sparrow *(Zonotrichia leucophrys leucophrys)*. The elevation here was about the same as that of Bray, at least 4500 feet, and there did not seem to be any particular reason why this bird should be at one place and not the other, yet here it *was* and there it *was not*. Several individuals were seen, but this was the only time this species was noted in Siskiyou County by the Academy party, during either visit.

Another trip was made to Orr Lake on June 2, via Keg, to investigate the sagebrush plain beyond the lake. This lake lies only a short distance from Bray, but the high water had washed out the bridge just outside the village and we had to go several miles around to reach it. On this occasion a couple of Black-billed Magpies *(Pica pica hudsonia)* were seen close enough for positive identification, and a nest was found from which the young had but recently departed. A young man working near by spoke of this nest, and said that he had seen the young in it but a few days before our visit.

Another addition made to our local list was Clarke's Nutcracker *(Nucifraga columbiana)*, a couple of which were seen and one secured for the record.

There were a good many thick clumps of willows near Orr Lake, and many acres of sagebrush, but a lengthy search of the vicinity of the lake brought to light only two very wary flycatchers *(Empidonax* sp.) and no thrushes or other birds whatever, with the exception of a few very common warblers. A Western Nighthawk *(Chordeiles virginianus henryi)* was seen flying overhead on this date, which was identical with that of its first appearance here in 1920.

On June 3 another addition to the list was made when a solitary Vaux's Swift *(Chætura vauxi)* was noted. Although this bird was mentioned in the Merriam report of 1898 as being common in the fall at Sisson, and a questionable record of one occurrence was therein given for Mt. Shasta, this was the first time I had come across the species in Siskiyou County.

After having watched a Killdeer *(Oxyechus vociferus)* going through various deceptive antics, calculated to draw our attention away from a certain area at the rear of our cabin, we finally discovered the nest on May 20. Analysis of the bird's actions seemed to show that incubation had not commenced until that date, or possibly the day before. The eggs hatched out on June 4, showing that the incubation period with this species is about 15 or 16 days. During the snowstorm of May 25 the birds exhibited great anxiety, neither of them going far from the nest when disturbed and returning to it very promptly. When we first arrived the birds made a great fuss whenever we came in sight, and for several days after the set was complete the sitting bird would hop off the nest if one of us appeared even in the door of the cabin, but they gradually grew more reconciled to our presence and would not stir unless we approached to within 30 or 40 feet of the nest.

In the cottonwoods across the meadow from our cabin Pacific Horned Owls *(Bubo virginianus pacificus)* were heard a few times, but no other species of owl was noted. An owl trap was maintained for a while on a favorably placed post within sight of the cabin, but without result.

Toward the end of May the young of the Oregon Ground Squirrel *(Citellus oregonus)* were large enough to crawl out of their holes occasionally when the sun was warm, but there was no indication of any of the Golden-mantled Ground Squirrels *(Callospermophilus chrysodeirus chrysodeirus)* having as yet brought forth their young.

The situation in regard to mammals this year at Bray was about the same as it was on my previous visit, except, perhaps, that mice were scarcer and Oregon Ground Squirrels more abundant, as well as less wary, than before.

As the high water in the meadows and the scarcity of birds at Bray did not seem to warrant a further stay there, our headquarters were moved to Yreka. The first intention was to go by way of Goose Neck Mountain, with the idea of staying over a night or so near the summit of the pass in order to see what fox sparrows might be breeding on the mountain. When it was learned that the road was still treacherous on account of the heavy snows of the season, this idea was abandoned, and the journey back was made over the Deer Mountain road, and then by a short cut across Shasta Valley, kindly shown to us by Deputy Game Warden J. O. Miller, of the Yreka district, who was making the trip that day. A sharp watch for birds was maintained along the way, especially around the 6000 feet elevation of Deer Mountain, but as was the case going over this route three weeks previously, hardly any birds were seen.

Yreka was reached about the middle of the morning of June 5, and a search for either a cabin or a good camping place was instituted, as the plan was to remain there long enough to enable us to make out a list of the birds of that locality, and to secure what we could that might be of interest in the way of specimens. After considerable inquiry and search, with no results so far as a good camping place was concerned, we secured an old miner's cabin, which was situated in a very isolated spot just outside the western limit of the town. This cabin had been unoccupied for some time, but there were no traces in it of the presence of rats or mice. Traps set among the scattered sagebrush and other bushes near it, and in the alfalfa field across the road, failed to bring in any returns whatever. The alfalfa fields in this locality are as often as not on hillsides, and without irrigation, yet there were no signs of gophers anywhere in the vicinity, nor were any rodents obtained therein. We were informed that a good deal of poisoning had been carried on in these fields, but it hardly seemed possible that such work could have made so clean a sweep of ground squirrels, gophers, mice, etc., as was indicated in this vicinity. It seems reasonable to believe that some other factor must have been at least partly responsible for this state of affairs, a condition that was most pleasing to the farmers but rather the reverse to the collector.

A few mice and common wood rats were found in the brush farther back at the base of the hills, but even here they were very scarce. Tin can traps, Vernon Bailey type, for catching specimens alive, were maintained along a road running up into the cañon to the Osgood mine, about a mile back of our cabin, but the results were so meager that this trap line was abandoned after a few days' trial with various baits.

Yreka is in a small valley by itself, on the banks of a little stream called Yreka Creek draining into the Little Shasta River to the north. The elevation is about 2600 feet and the zonal character of the country is nearer Upper Sonoran than anything else. This, however, runs rapidly through Transition into Canadian on the mountains west of the town. There is a good deal of open land in this valley, mostly with a poor-looking soil, and there are some areas of sagebrush; but the hills to the westward are covered with various sorts of brush, scrub oaks, and timber.

Most of the soil is stony or gravelly, and a great deal of placer mining has been done in this vicinity. Some mining is still going on, and the hills are scarred with numerous tunnels, dumps, prospect holes, and other insults to Mother Earth, incident to the search for gold.

A stay was made in this neighborhood from June 5 to June 17, some days being spent in the close vicinity of the town and others in prospecting around the adjoining country in the car, observing the bird life and collecting specimens.

About the town were a number of common species of birds that one would be apt to find in almost any town in the Sacramento Valley. House Finches *(Carpodacus mexicanus frontalis)* were especially numerous, with many broods of full-grown young flocking together. In the cañon and on the hills west of the town the Mountain Quail *(Oreortyx picta plumifera)* seemed to be quite numerous at this time of year, but exceedingly wary. These birds could be heard calling in the brush, but, in spite of long continued effort to secure a specimen or two for comparison with others from the coast, a fleeting glimpse of a single bird was the nearest we came to securing one. Occupying a territory so near the town, these quail must be hunted unmercifully during the open season, and it is only their extreme wariness that saves the species from extinction in these parts.

The Dusky Horned Lark *(Otocoris alpestris merrilli)* is found in places on the undulating, treeless plain east of Yreka, and this bird was especially numerous in Butte Valley, a few miles northeast of the town. In one field of freshly cut and cocked hay there were a great many birds of this species, a large number being young from half to three-quarters grown.

Barth made a trip up the mountain directly back of Yreka, reaching an altitude of at least 4000 feet, but did not come across any fox sparrows, although the brushy slopes were well adapted to the needs of these birds. We met the mining engineer in charge of the idle Osgood Mine, who was fond of birds in a general way, and asked him if he had seen any fox sparrows in that vicinity, describing the bird to him. He said that he had not noticed any on his walks on the mountain back of this mine, but that he had been staying at the Mt. Vernon Mine, about nine miles by road southwest of Yreka, and that the wife of the superintendent of that mine had shown him some sparrows, which she thought were fox sparrows, that came every day just back of her house to feed on crumbs thrown out to them.

A trip was made to this mine and the matter investigated. Mr. and Mrs. Daubyns gladly showed us the birds, which verily were fox sparrows, and very kindly asked us to come out and remain for a few days in order to look around for more, as there were apparently only two or three individuals down at the level of the dwelling house.

The Mt. Vernon Pass, through which runs the county road, is about 4400 feet in elevation, while the mine buildings are 200 to 300 feet lower, being situated in a steep cañon on the east side of the pass.

Around the building were a good many birds of common species, but farther away and up on the mountains on either side of the pass they were very scarce. Traps were set for rats and mice near the mine buildings and in the pass, but hardly anything was taken.

About the most abundant bird here was the Sacramento Towhee *(Pipilo maculatus falcinellus* Swarth), and an interesting thing about it was the height at which it was noted on the mountains adjacent to the Mt. Vernon Pass, it being commonly found as high up as 5000 feet and over. This altitude was considerably greater than that of any other locality in Siskiyou County in which the Academy party found this species, upon either the field trip of 1920, or 1922.

Mr. and Mrs. Daubyns clear the snow off a place back of their house and feed birds there all winter. They state that some of the Sacramento Towhees remain at that altitude throughout the coldest weather and during the heaviest snows. While it gets very cold in the little hollow under the pass where the mine is located, it is well sheltered from storms and there is plenty of good cover to protect the birds. There are some fox sparrows that come to the feeding ground through the winter, and Mrs. Daubyns thinks that her summer guests are among them, but is not absolutely sure of this.

The fox sparrow in this range is practically the same as the one found at the base of Mt. Shasta, that is, the Yosemite Fox Sparrow *(Passerella iliaca mariposæ* Swarth). On some maps this is called Forest Mountain Range. The Academy field party of 1920 was encamped for several days near Robbers' Rock, Forest House Mountain, which is in a continuation of this range. In that vicinity, however, we did not find any fox sparrows, or any good brush for them. Even at Mt. Vernon these birds were quite scarce and very wild. We had great trouble in securing any for identification, as we did not wish to destroy those that were semi-domesticated in Mrs. Daubyns' back yard. As no birds of this genus had ever been reported in this part of the country, however, we made patient attempts to obtain some, and finally succeeded in securing a few upon the range above the pass.

On the former visit to this range, the Sierra Hermit Thrush was found breeding in some numbers near Forest House Mountain, but on the Mt. Vernon portion of the range this species was very scarce. I heard one singing in the woods high upon the ridge, and, after several attempts, finally succeeded in getting very close to it, without securing it, however, and no other opportunity offered. This bird probably had a mate nesting near by, but only one other individual was heard during our stay, and none seen. The two that were heard were at an elevation of about 5000 feet.

A mile or so south of Yreka some dredging operations had been carried on in the valley of a small creek running down from the Mt. Vernon Pass. This valley is fairly level and comparatively wide for about a mile above its junction with the Yreka Creek, and some small ponds had been left at the edge of the great masses of gravel piled up by the dredge. Tules and willows had taken possession of these ponds and a small colony of Nevada Red-winged Blackbirds *(Agelaius phœniceus nevadensis)* had been nesting there. A few of the young ones flying about were taken for comparison with specimens of juveniles of other forms of this species. A pair of Virginia Rails *(Rallus virginianus)* was also nesting in one of these ponds.

Such other species of birds as we noted on this part of the Forest Mountain Range were about the same as those already recorded as occurring at the Forest House Mountain camp of 1920.

We had gone to the Mt. Vernon Mine on June 13, which was the first day since June 5 that there had not been from one to three thunderstorms a day, with occasional torrential showers and continual threats of more.

On June 16 we returned to Yreka for the remainder of our outfit which had been stored there, and on the next day we moved camp to a spot near the summit of the Salmon Mountain Range, on the road from Scott Valley to the forks of the

Salmon River, about nine miles southwesterly from Ætna Mills (Siskiyou County). There is a government bench mark denoting 5969 feet beside the road at the summit of the pass. The only accessible spot level enough for our car and camp that we found on the mountain side within several miles of the pass was about three-quarters of a mile from the summit on the north side, at about 5500 feet elevation. Here a remnant of an old stage road was still passable enough to enable us to get about 100 yards from the present road, and gave us space enough to park the car and set up camp beside a noisy little stream coming from the melting snowbanks higher up.

Patches of snow yet remained a short distance above camp, and there were some very heavy drifts on the north side of the pass which appeared to be deep enough to last through the summer. The draft of air that set down this cañon through the night was anything but warm after passing over these snowbanks, and the birds of the vicinity evidently preferred a more moderate temperature. In the bottom of the cañon hardly a bird was seen, and this was the case with the northerly exposed hillsides. The small mammals also had the same preference for warmth as had the birds.

The southerly exposures of this mountain range are more or less covered with different species of Ceanothus and other brush, in the warmer places with few or no coniferous trees growing among it, but in colder spots with varying degrees of tree growth scattered through it until replaced by actual forest. In places where there was plenty of water near the surface, there was a dense growth of scrubby willows, flattened down by the winters' heavy snows, through which one could make one's way only by means of the ill-defined paths used by cattle during the summer months.

Through most of this brushy country fox sparrows were nesting and some of them were taken for identification. Up to this time no member of the genus Passerella had been recorded from this part of the state, so that it was with considerable interest that the first specimens were here secured. One of the main objects of coming to this locality was to endeavor to define the range of the Yolla Bolly Fox Sparrow (*Passerella iliaca brevicauda* Mailliard), which race is known to breed on the mountains of Trinity and Tehama counties, to the south of Siskiyou County. We know something about the southern limits of its range but nothing was known concerning the northern extension of its habitat. The specimens taken here on the Salmon Range, appeared to be more or less intermediate between the Yolla Bolly Fox Sparrow and the Yosemite Fox Sparrow *(Passerella iliaca mariposæ* Swarth), making it evident that we were approaching the necessarily rather indefinite boundary line between the summer habitats of these two races.

While the fox sparrows in California are inclined to be very wary, and usually select nesting sites in well-hidden places where they are not apt to be disturbed, they sometimes go to the other extreme. For example, Barth found a nest, with young just hatched, not 10 feet from the road, over which heavy trucks were daily passing, transporting equipment for some hydraulic plant that was evidently being established on a large scale. The noise made by these trucks on the steep grade was deafening, but that did not deter the birds from the work of incubating the eggs. This nest was built about four feet from the ground, in a branch of a fir sapling, the sapling being one of a small clump by the side of the road.

Except for these trucks and an occasional band of cattle driven over it, there was but little travel on the road, so that bird life was not seriously interfered with in that region. The mail carriers who take the mail over the pass are furnished with cabins in which to live in the winter time during the season of heavy snow. We had permission to use one of the cabins, but they were in such positions that it was impossible to get the car to either of them, and as there was no place in which to park it along the narrow road, the idea of making a stay in one, in order to have better protection in case of bad weather, had to be given up.

It seemed as if hermit thrushes should be breeding in such a place as this, but only the Russet-backed Thrush *(Hylocichla ustulata ustulata)* was found. A few males of this species were heard above our camp, but they were remarkably wild and hard to locate. One nest was found in a bush of *Ceanothus velutinus,* and, after many trials, the parent was secured for positive identification. The few of these thrushes we took are paler in color than the general run of this subspecies, but not enough to place them with any other form.

In a small willow on the steep mountain side just below a very heavy snowdrift, a Wright's Flycatcher *(Empidonax wrighti)* had built a nest. The selection of this site was another instance of poor judgment on the part of a bird, for it was at the edge of a cattle trail that had been cut through the thick willow copse to expedite the handling of the large bands of cattle which are driven into the mountains in the spring and out again in the fall. Just before the nest was found a band of cattle had been driven through this short cut, and they certainly must have brushed against the tree in a manner most threatening to the existence of this nest.

Other than fox sparrows, only some 25 species of birds were noted here during our stay. As there was nothing among them that one would not expect to find in just such a locality, it hardly seems worth while to enumerate them. It was rather singular, however, that no grouse or quail were in the list of birds seen or heard here, although the locality was explored to some extent both above and below the altitude at which our camp was situated.

Traps were maintained for small rodents and some were taken, mostly Peromyscus of common species. The ants here were especially voracious and ruined many of our catch before we could get around to rescue them. The Golden-mantled Ground Squirrel *(Callospermophilus chrysodeirus chrysodeirus)* was present in small numbers near camp, but did not seem to be very active, as it was seldom seen. One female that was captured contained four embryos in about the same stage of development as some from an individual taken a month earlier at Bray, at nearly the same elevation.

On June 20 the weather became cold, cloudy, and threatening. As we were in a poor place to stay through a storm, and as the object of the visit to this range had been accomplished —that is, the discovery of fox sparrows thereon, and the securing of some of these birds for specimens—we packed up and left the next morning, with the intention of examining the range between Scott and Shasta valleys.

For a long time it had seemed to me remarkable that the Alexander Expedition of 1911 to northern California had come across fox sparrows in summer in but one place, which was at Castle Lake, some miles south of Sisson and on the Sacramento watershed. In her report upon this expedition Miss Kellogg[1] says, referring to Castle Lake, "The latter was the only locality where any form of fox sparrow was encountered during the summertime." The only answer that suggests itself to this is that the Alexander Expedition did not happen to settle down in, or examine, any spot at the higher altitudes which are adapted to the needs of this genus. Either that, or else some of the forms of this genus must be extremely erratic in habits and choice of breeding ground.

According to the map of the itinerary of the expedition, Misses Alexander and Kellogg, traveling by stage, passed through the spot where our next camp was made, and where we found fox sparrows quite common, though not very numerous. This was on the southern slope of Gazelle Mountain, about a mile by road south of Gazelle Mountain Pass, where we established our headquarters at the edge of a rather open forest of oak and yellow pine, with patches of Ceanothus of various sizes scattered through it. A tiny ditch, which was probably an old mining ditch, brought water to a small ranch house a couple of hundred yards below us. The buildings here were evidently those of an old stage station, with the necessary barns, etc., and the place is down on the maps as Mountain House. It turned out that this camp was only seven or eight miles west of Stewart's Springs, where we failed to find any fox sparrows in 1920.

Callahan Mountain, several miles away to the southeast, was opposite us, and was connected with Gazelle Mountain by a rocky and brushy mountain range, probably nowhere much over 1000 feet higher than the pass, which is about 4000 feet. The southerly side of Gazelle Mountain, on the other hand, is a good deal diversified, with open stretches, brushy spots and considerable timber, although none of the latter is at all thickly set. This timber is rapidly being destroyed by one of the detestable sawmills that are ruining so much of our beautiful timber country with their ruthlessly destructive methods.

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[1] Mammals and Birds of Northern California. <Univ. Calif. Publ., Zool., Vol. 12, p. 384, 1916.

Upon our arrival at this place my first thought was that it would prove to be about the worst collecting ground we had as yet come to, which would have been poor indeed. It was a hot day and but little evidence of bird life appeared that afternoon. In the refreshing coolness of the early hours of the next morning this idea was soon discarded. There was more bird life around us than in any other place we had visited in Siskiyou County, showing that this little, narrow, but rather open valley must be a favorite spot for many species. Evidently its climate is a comparatively moderate one, judging from the character of the plant life, and the rainfall must be rather light, the Salmon Range to the westward catching most of the moisture before it reaches Gazelle Mountain. A great mixture of plant life was noticed here. Yellow pines, various oaks, scrub-oak brush, Ceanothus, etc., occurred in larger or smaller areas, often separated by thin patches of sagebrush. The soil is rocky and of poor quality, and grass was almost non-existent, the dried remains of the little that had grown looked as if the growth had been checked soon after it started. Yet, in spite of its unpromising appearance, this locality proved to contain more species of birds and more individuals than any we had previously found.

The greatest surprise in this line was the presence of fox sparrows here, not in abundance, but well represented. The form breeding here is the Yosemite Fox Sparrow, though with rather a heavier bill than belongs to this race farther south.

Just back of our camp near the Mt. Gazelle Pass were some small clumps of buck brush *(Ceanothus cuneatus?)* scattered through the very open woods, and I had some mouse traps set in some of them. Every time the traps were visited in a certain one of these clumps, about 75 yards back of the camp, there was a male fox sparrow singing close by, and several times another fox sparrow suddenly appeared on top of a bush at one corner of the clump. It seemed as if there must be a nest in that particular, rather large, spreading bush, but diligent search on several occasions failed to reveal one, although the female fox sparrow frequently appeared to flush from near the center of it and very low down. She would sneak away and join the male somewhere near, then the two would soon return. The pair would then go into the bush together and the male would come out alone, fly into a nearby tree and begin to sing. Finally, on the morning of the last day of our stay there, it was arranged that at a given signal Barth would approach quietly from the outside toward this corner of the clump, while I crawled cautiously into the brush, until within sight of this bush, with the idea of possibly being able to see the bird when it flushed. By good fortune the scheme worked well, and the nest was located. It turned out to be set in the ground, directly under and against one of the central trunks of the bush, in such a position that only when the sun was shining through the trees in such a direction as to illuminate to some extent the interior of the bush on the proper side, could the nest be distinguished through a small opening among the branches. The nest contained two fresh eggs and evidently was not finished when its existence was first suspected. The female was secured for positive identification, but the male kept on singing in the vicinity for the greater part of the day, as if nothing had happened to disturb his family life.

During our observation of these fox sparrows, the male was twice seen viciously driving away from the vicinity of the bush, under which the nest was finally found, a diminutive and unobtrusive little Western House Wren *(Troglodytes aëdon parkmani)* that was busily searching for insect food with which to appease the voracious appetites of its young, which were clamoring constantly for more in an old woodpecker hole in an adjacent stump.

While watching these sparrows we witnessed a singular fight, high up in the air, between a pair of Western Red-tailed Hawks and a Golden Eagle. The Hawks were badgering the eagle, which probably had intruded upon their self-determined domain, striking at him, sometimes separately and sometimes concertedly, generally from above. When struck at, the eagle would scream in what seemed a terrified manner, although this might have signified only rage. No damage was apparent from our position, and no feathers were seen to fly.

Most of the 40 species of birds noted here during our stay were those that might be found in the Transition Zone almost anywhere along the foothills of the Sierras on the east side of the Sacramento Valley, the exceptions being the Sierra Red-breasted Sapsucker *(Sphyrapicus varius daggetti)* and the

Mountain Bluebird *(Sialia currucoides)*, which are usually found rather higher up than in the foothills proper. But one owl was heard and none seen at this camp, the one heard being a horned owl, probably the Pacific Horned Owl *(Bubo virginianus pacificus)*. If there were any other species of owls about they kept remarkably quiet.

The season was by this time getting late for collecting, so but few adult birds were taken on account of the danger of breaking up families of young. Juvenile birds were especially sought for, to complete series for life histories, but it seemed to be still a little too early to find young ones out of the nests.

Small mammals were scarce. As is the case in a good part of Siskiyou County, pocket gophers (Thomomys) were not in evidence here. The small irrigating ditch, mentioned above, wound its way around the hillside without interference from these pests, and quite a field was kept green below it by the simple expedient of checking the flow of water in the ditch at intervals, and letting it spread slowly down the slope of the hill. This could not be done if gophers were present, for the reason that their burrows would carry off the water so rapidly that the soil would soon wash away.

The time allotted to this field work was rapidly drawing to a close, and, on June 26, camp was broken at Gazelle Mountain and a start made toward home, with the intention of passing a day or two near the highway between Weed and Sisson. On that day we made a stop between these two places, about four miles from Weed, in a small grove of coniferous trees about three-quarters of a mile from the base of the prominent cinder cone called Black Butte, to see what there might be in that region at this date.

The weather had been very warm for several days, and on this particular afternoon it was really hot, yet, in spite of the intense heat, a few fox sparrows were singing near camp at intervals until after sunset. At this place the early morning was quite chilly, and it was noticeable that these birds did not commence to sing until the sun had warmed up the air very perceptibly.

The fox sparrows apparently were well along with their nesting here, yet, late in the season as it was for this elevation (probably 3500 feet), an apparently new nest was found with nothing in it, but with the owner hovering near. There were a good many chipmunks in this locality and perhaps some of them were responsible for the emptiness of the nest, as observers in certain localities blame these animals for the large number of robbed nests they have noticed.

Some mouse traps were set out around camp the afternoon of our arrival here, but only two were sprung, and the two young Peromyscus they contained had been badly damaged by ants before they were found early next morning. Traps were also set in a promising looking meadow across the road, but without result. Contrary to our experience in other parts of Siskiyou County, we found gopher workings quite abundant at this spot. In the extremely dry, ash-like soil it was difficult to locate fresh workings, and a single gopher might be responsible for a large number of the mounds visible in the vicinity. One specimen, *Thomomys monticola,* was secured.

No owls were noted here, but a Pacific Nighthawk was heard at intervals throughout the night. It was rather remarkable that owls were heard at only two places on this strip of seven weeks' duration, and then none but the Pacific Horned Owl. This may perhaps be accounted for by the notable scarcity of small mammals wherever we went.

This field trip was concluded on June 28, and the return made to San Francisco.

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IV

FALL FIELD WORK IN PLUMAS AND YUBA COUNTIES, CALIFORNIA, IN 1922

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The autumn field work of the department for several years past having been carried on in the mountain ranges between the Sacramento Valley and the coast, principally for the purpose of observing the fall migration of birds, especially of fox sparrows, it was decided to examine the foothills on the northeastern side of that valley in the fall of 1922, with a similar object in view.

With no data at hand as to favorable localities for such work, and utter failure being the result when it came to questioning individuals in this regard, it was a matter of pure guesswork where to make a start. As the town of Quincy, Plumas County (California), at an elevation of 3180 feet, seemed to be well situated, judging by the map, and as there was living there a man who was known to be interested in natural history, although in an untrained way, it was decided to make this place the first objective, and it was reached by way of Oroville on September 8.

It was hoped that a good spot might be found on the road to Quincy, in the 64 miles over the mountains from Oroville, but nothing in the way of an attractive locality was found at

October 15, 1923.

a sufficiently low altitude for the work. At altitudes of from 5000 to 7000 feet on the mountain range between Oroville and Quincy there was a good deal of brush land, varied by timber and open places, that looked all right, but no bird life was noted as we traveled slowly along. It was hardly to be expected that any large number of birds would choose such altitudes for lines of migration at this time of year when they would be subject to the very extremes of temperature and succession of storms they were traveling southward to escape. However, in early autumn this is not a fixed rule, for birds often remain at comparatively high altitudes, when attracted there by a plentiful food supply, until actually driven out by adverse weather conditions.

Quincy lies in quite a level little valley, in which there are probably at least 2000 acres of good to fair meadow land, with a stream or two running through it. Out in this open land there were a few of the species of birds that are seen in the fall almost anywhere in the Transition Zone in California, the Western Meadowlark *(Sturnella neglecta),* California Brewer's Blackbird *(Euphagus cyanocephalus minusculus* Grinnell), Audubon's Warbler *(Dendroica auduboni auduboni),* and Western Bluebird *(Sialia mexicana occidentalis),* with a few goldfinches and a common hawk or so, being the principal species noted. Rather strange to say, there were no marsh sparrows (Passerculus) seen anywhere in these open fields.

Southeast of Quincy there is a good deal of fairly level land that was covered formerly by coniferous forest, but which has not only been denuded of trees, but has been devastated by numerous fires. In this territory there were but few birds, and no flycatchers, of which not a single representative was noted during our stay of nine days.

On the mountains about Quincy there is some rough, rocky country, with forest running up the cañons, yet there was but little "buck brush", or attractive looking cover for fox sparrows within reach. Running through the center of the meadow west of the town was a sort of slough, probably an old bed of the stream which flows through the valley; and along this slough was a heavy growth of brushy willows, forming a fine cover for sparrows. In the thickest of this willow growth there were a great many song sparrows, and one or two glimpses were obtained of what appeared to be fox sparrows, but there was such a thick growth of grass and weeds from four to six feet high, with about a foot of water at the base, that it was absolutely impossible to carry on satisfactory observations there. As to collecting specimens for identification, there was no use trying, for none could be retrieved from this mass of dead and living herbage.

By the kind permission of the owner of the land, camp was made beside a spring of exceptionally pure water at the northern edge of a grove of small firs about half a mile west of Quincy.

During our stay here the afternoon temperatures were quite high, when the shade of the trees was much appreciated; but the early mornings were very cold, with frost in the meadow opposite and a cold draft flowing down on the camp from the cañon behind it.

It seemed as if the spring, which flowed only for some 50 yards, might frequently be visited by birds, but such was not the case. Birds were most noticeably scarce in the vicinity, and also in an attractive looking cañon near at hand, which had a stream of water flowing down it and brush and forest on its sides. Possibly the fact that this narrow cañon had a northern exposure made it too cold to be a favorite locality. There was some good cover here for birds,—consisting of several different kinds of brush, including Ceanothus, oaks, alders, firs, etc., in profusion,—yet there were practically no birds. A few kinglets, a chickadee or two, a couple of Sacramento Towhees *(Pipilo maculatus falcinellus)*, and an American Dipper *(Cinclus mexicanus unicolor)* were about all that were met with in a half mile walk up this cañon to the end of the trail, beyond which the cañon was almost impassable on account of the thick brush and the rough character of the surface.

Mr. W. B. Smith, my assistant on this trip, who had had but little experience with birds it should be said, was sent up on the mountain above camp, with instructions to bring in whatever he might come across, but he reported that there was almost no bird life there.

The country was explored in our car for some miles along each road that led out of the town in an endeavor to find some favorable looking spot for observation, but nothing was located that appeared to be more promising than where we were.

Traps for small rodents were set along the edge of the woods and in the meadow. In the woods very little success was met with except in one instance, when Smith was instructed to set out some traps along an old brush fence,—this being, incidentally, the first trapping of the kind that he had ever attempted,—and the next morning had a couple of white-footed mice, a shrew, and a Mazama Red-backed Mouse *(Evotomys mazama* Merriam) in his traps. This last mentioned specimen is a new record for the interior of California, south of Mt. Shasta. The skin and skull of this specimen were sent to Washington, and finally passed upon by Mr. A. Brazier Howell, who is at present working on the western microtines. He has the following to say regarding it: "The coloration of that *Evotomys* can be matched in both *obscurus* and *mazama* series. . . . The Quincy specimen is fully as dark as average *obscurus,* but with even less reddish dorsally. However, it has the large feet and bullæ usual in *mazama,* and had better be called that at least until more are obtained. If it has escaped in that region for so long, it may yet be obtained in the more southern Sierras." Mr. Howell is confident that these two forms are only subspecifically distinct, as there is so much overlapping of characters.

Dr. Walter K. Fisher informs me that he took a red-backed mouse at Quincy nearly 20 years ago, but apparently this fact has not been recorded in any publication. Curiously enough, Smith took nothing else in his traps after having had this one piece of good fortune.

In the meadow, traps were first set along the bank of the slough mentioned above, but the results were far from encouraging although the settings were made in long grass where small runways were easily discernible. In one part of the meadow, where the ground was quite damp, the grass had but recently been mowed very short, and here were many holes of meadow mice with distinct runways between. Traps carefully set in these runways brought good results. Fair results were also obtained with some traps set near by in a still damper place, where there was considerable old grass yet remaining. This spot, however, was the habitat of a large carrion bettle *(Necrophorus hecate* Bland), which appeared after sunrise and quickly destroyed any of the meadow mice that were still in the traps. Unlike most of the other genera of small rodents, these meadow mice move about to some extent in the daytime, and traps set for them have to be looked after accordingly. In this spot the traps were visited before sunrise and again a couple of hours later, but even so, several specimens caught were dismembered and either eaten on the spot or actually carried away by these beetles. The examples of Microtus secured seem to be of the race described by Dr. Joseph Grinnell as the Yosemite Meadow Mouse *(Microtus montanus yosemite)*.[1]

It seemed rather singular that not a single brush (Silvilagus) nor jack rabbit (Lepus) was seen in our wanderings in the neighborhood of Quincy. The latter are probably too much cut off by forest from the larger areas of the open country that is their natural habitat, but there seemed to be no good reason for the absence of brush rabbits, as all this valley is in the Transition Zone. Possibly the brush rabbit, cut off from here by the mountain ranges, has never worked up the cañons from its known habitat in the Sacramento Valley.

One small family of Mountain Quail *(Oreortyx picta plumifera)* was found by the road about a mile southeast of Quincy, but no others were seen or heard anywhere in the vicinity.

This valley proved to be so barren of bird life that camp was struck on September 16 and the road to Blairsden was taken with the idea of looking for a better locality. Nothing attractive being found, we went over the mountains, by way of Mohawk, Gold Lake, and Downieville to Goodyear's Bar, spending the night at the last mentioned place.

On the way over a sharp lookout was maintained for a suitable spot in which to locate. A spring was found near the road, not far from the top of the range just east of Gold Lake, but the altitude was such that it was deemed inadvisable to camp there. Another very promising looking piece of country was passed through at the foot of the Sierra Buttes, at an elevation of probably about 4000 feet, but no spot suitable for a camp ground was found along this stretch of road. Farther down toward Downieville, the buck brush, manzanita, etc., gave way to a tree-covered country, not favorable for our purpose.

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[1] Proc. Biol. Soc. Wash., 27, pp. 207-208.

The morning following our arrival at Goodyear's Bar, a discussion regarding the character of the country around about was held with the forest ranger, and, from his description, the neighborhood of Challenge, Yuba County, seemed to hold forth the greatest promise of success.

Disagreeable as it was to do so, we had to leave the splendid mountain road on which Downieville, the county seat of Yuba County, is situated, and take a rough, steep, and narrow country cross-road to reach our destination. We arrived at Challenge early in the afternoon, and, after a discussion concerning the locality with some of its residents, we finally established a camp at the edge of the woods at the east end of what was known in the placer-mining days as "New York Flat", about three miles west of the Challenge postoffice.

This pleasant camp was situated close to a rather ancient ranch house (occupied by a Mr. Wetmore, to whom we were indebted for many kindnesses and courtesies), in a region appearing to be one of much promise. Round about were meadow lands, brushy tracts, and patches of forest, with some abandoned orchards here and there; but we soon found that it was a land of promise only, for, as at Quincy, there was a paucity of both bird and mammal life. The season had been unfavorable in some ways, causing a failure of the acorn crop, and although there were many dead trees with storage holes made by the California Woodpecker, these holes contained no acorns.

After searching the country in several directions for better ground, it seemed advisable to move a little lower down to a place called Rackerby, a relic of the old mining days, about six miles nearer Marysville on the La Porte road. At one time a station of some importance, Rackerby is but a remnant of what it used to be, consisting now of only a small cluster of houses and a postoffice. There are a number of old orchards and vineyards in the vicinity, and just across South Honcut

Creek, which, at this point, forms the boundary line between Yuba and Butte counties, a ditch that was formerly used in mining operations winds its way along the ridge westerly from Rackerby. In some small holdings on its banks the water from this ditch is used for irrigation purposes, but only to a very limited extent owing to the hilly character of the country.

There is some good brush around here, and this was the first time in over 100 miles of search that we came across a spot at a low elevation which seemed one in which to expect to find fox sparrows. In this locality there are some thick patches of manzanita and Ceanothus which appear to be connected with like association on a series of hillsides and cañons to the north and south. This more or less brushy country is only a few miles wide, with an elevation of probably about 1500 feet above sea level, and extends from the forest country on the east to the more open, oak-covered country on the west. It bore the appearance of being an extremely likely line of migration for fox sparrows. In fact, this stretch between Challenge and Rackerby seems to be the only logical route for this genus to take along these foothills between the Sacramento Valley and the higher elevations of from 4000 to 7000 feet.

At the time of our arrival at Rackerby, September 21, the weather was very warm and dry and there was no sign of frost, while at Challenge, 600 or 800 feet higher, the early morning temperatures were below freezing point. Near Rackerby were a number of beautiful, large fig trees, bearing their last crop of fruit for the season. This crop the owners were busily gathering as it fell to the ground, and drying. Besides these fig trees there were several old orchards and vineyards here, mostly still bearing fruit, and wild grape vines grew along the watercourses.

It seemed like an ideal place in which to find many species of birds, but here again their number was small. In fact it was remarkably small, when the profusion of food in the vicinity was taken into consideration. Possibly there was less insect life present than one might have imagined, but it was astonishing to find no juncos, tanagers, warblers, chickadees, nuthatches, kinglets, thrushes, or bluebirds at this place, which seemed to be in an association so eminently fitted for these species at this time of year. Woods, brush, open lands, weeds, scattered trees, orchards, vineyards, brooks—what more might birds want? One bird, however, was not only common, but sufficiently so to be a nuisance,—so much of a nuisance that the owners of fruit trees had been encouraging the boys in the neighborhood to shoot all of this species that they could, with the result that, while still comparatively numerous, these birds had grown very wise and shy. This pest was the Long-tailed Jay *(Aphelocoma californica immanis* Grinnell), which was doing all it could to prevent the market from being overloaded with Rackerby fruit.

The first thing we did at this place was to endeavor to locate some springs in the brush where fox sparrows might come to drink. One was found at the side of a road leading to a mine in the vicinity, and it was visited early in the morning of September 22, with some success. Several fox sparrows came to the spring, or were seen in the brush near it, and three of them were secured. The Pallid Wren-tit *(Chamæa fasciata henshawi)* was very numerous about this spring and so tame that individuals kept coming within a few feet of the observer, scolding, chattering, and fussing around in their customary "busy-body" way to such an extent as to make it very difficult to keep track of the fox sparrows' movements, as any motion of twig, leaf, or other object has to be noted and analyzed during the period of observation.

We visited this spring again early the next morning. Three or four fox sparrows had been noted already, and a couple of them secured, when two men came along with picks and shovels and proceeded to drain the spring into a pipe in order to use the water at a distance. While a little of the spring was still available to the birds after this operation was completed, no water dribbled across the road into the brush below, and as it was there in the rather deep bed of the rivulet that the birds preferred to come to drink, the spring was ruined for our purposes. It seemed as if the spring itself, dug out and boarded over as it was, but not screened by bushes, had lost its attraction for the birds, as almost none visited it thereafter, although there were some trees and fairly good cover only a few yards distant.

About half a mile away, in a hollow below a sharp bend of the county road, another spring was discovered, and it was visited in the early morning of September 24. Only a few moments after our reaching it, however, the same miners who had spoiled our other spring for us, came along and commenced to cut for fire wood the trees directly protecting this one, and frightened any prospective bird visitors away from it.

After this episode, a couple of days were spent in investigating the possibilities of the old mining ditch previously mentioned, and the brushy patches along it. There were tall weeds in places on its banks, tangles of wild grape vines, wild lilac (Ceanothus), and some quite thick patches of brush here and there not far away, but there were no birds to speak of, not even song sparrows in the damp, weedy spots.

Some springs were found near brushy country about a mile and a half from our camp, but not very well situated as regards safe approach by birds, which would have to pass through some yards of open before reaching the water. A few birds came there, among them two or three fox sparrows, but the place was very difficult to watch properly and so few visitors appeared that it was on two mornings only that any attempt was made by us to do any work there, and then with very little success.

The deep, wooded, and brushy cañon of South Honcut Creek, a few hundred yards west of Rackerby, appeared to be a good place for certain kinds of brush-loving birds, but an examination of this locality proved that it was almost devoid of bird life. Possibly it was too cold and dark at this time of year, although it seemed to be an ideal place for song and fox sparrows.

Along a narrow ridge on the east side of this cañon, and just southwest of Rackerby postoffice, there were some good patches of heavy brush, consisting largely of wild lilac bushes, and, toward the end of our stay at this place, we found fox sparrows there. The creek cañon (with proper cover well up near the top along both sides) runs north and south along here and should be a good line of migration for this genus, but although we found some of these birds in the brush on the east side of the cañon, as just stated, we did not find a single one on or near the top of the ridge on the west side, notwithstanding the fact that there was equally good cover there.

The fox sparrows found on the east-side ridge were extremely shy and difficult to secure in the heavy brush, and were not at all abundant. This condition of affairs was very much the opposite of my experience near the coast in southwestern Humboldt County (California) in the previous fall (Condor, XXIV, 1922, pp. 48-53), when these birds were found to be very numerous and tame.

The weather had been very dry and warm, actually quite hot in the afternoons, 100 degrees in the shade some days, up to October 1, when a change took place, resulting in wind, rain, and thunderstorms for the next three days.

We had been finding an occasional fox sparrow here and there from day to day, but, with the exception of the first day at the spring which the miners spoiled for us on September 23, when several individuals had been noted, it was not until October 2 that we saw any number of this species. On that date, in the afternoon after a stormy night and morning, we saw several individuals on the ridge east of South Honcut Creek. Heavy wind and rain occurred on October 3, but after the wind had died down a little an attempt was made to find some fox sparrows between showers, with no success. The weather cleared off in the night and on October 4 we found a few of these birds on this ridge, securing five altogether and losing several others. October 5 was fine, but there were not so many fox sparrows about as on the previous day, although several were seen and five more secured.

As the next day was the one set for the ending of this field work, observations on the fox sparrows were brought to a rather premature close, but enough specimens had been obtained to give a good idea of the status of the subspecies migrating along this interior route.

For the region we were working in there is little or nothing on record, but, as some winter specimens of the Slate-colored Fox Sparrow *(Passerella iliaca schistacea)* have been recorded from Sierra City *(vide* Swarth, Univ. Calif. Publ., Zool., Vol. 21, No. 4, 1920, p. 201) it was expected that this form would be taken along these foothills among the fall migrants. This turned out to be the case, but the proportion of this form to that of the others taken was much greater than had been anticipated. Concerning what other races might be found here one would hardly have been able to make a guess, except that the Yosemite Fox Sparrow *(Passerella iliaca mariposæ),* which breeds in the Sierras at 4000 feet (north of the Sacramento Valley) and upward, would be the form most likely to be found. Of the 23 fox sparrows we secured at Rackerby, there were 13 Slate-colored, six Yosemite, three Yakutat *(P. i. annectens),* and one Valdez Fox Sparrow *(P. i. sinuosa).* Of these, the members of the Schistacea group,—that is to say, the Slate-colored and Yosemite fox sparrows, with gray coloration predominating and reds at a minimum,—were found from September 22 on to the date of the ending of our work; but the members of the Unalaschcensis group, with red coloration predominating,—namely, the Yakutat and Valdez fox sparrows,—appear to have come to the scene more toward the end of our stay, as none was secured before October 2.

During the course of his painstaking and comprehensive work of revising the genus Passerella (Univ. Calif. Publ., Zool., Vol. 21, No. 4, 1920), which resulted in the publication of his valuable addition to our limited knowledge of the life histories of our western representatives of this genus, Mr. H. S. Swarth gathered together for examination about 1800 specimens of this genus from the Pacific coast. Of these, over 700 were in the collection of the Museum of Vertebrate Zoology, University of California, while the remainder were carefully selected according to date of taking, locality, etc., from the available collections of museums and private collectors, thus assembling a greater amount of material for working upon than any student of the genus had ever before had access to. In spite of this large aggregation of material, however, the region along the foothills on either side of the Sacramento Valley, especially toward the northern end, is very sparsely represented in the list of localities from which these specimens were secured.

From the eastern side of the Sacramento watershed the Slate-colored Fox Sparrow is recorded in this list only from

Blue Cañon and Cisco, Placer County, and Sierra City, Sierra County, the two first mentioned localities being quite near each other and about 20 miles south of Sierra City. All three are pretty well back in the mountains, and are close enough together and so similarly situated as to be practically in one region. From the western side of this watershed none of this subspecies is noted in the list, but from that region there are two specimens in the Academy collection, which were taken in Lake County since Mr. Swarth's paper was published.

The Yosemite Fox Sparrow breeds all along the Sierras, from central Siskiyou County south through the Yosemite region, but fall and winter records are very scarce, except in southwestern California, where a few winter records have been made. In place of finding this race numerous at Rackerby, as had been anticipated, comparatively few were taken, and they were not at all typical *mariposæ*. In fact, I had to compare them very carefully with the closely allied races before deciding to place them with that subspecies. The six specimens procured at Rackerby stand in a group by themselves when their bill measurements are compared with those of other lots of unquestionable, breeding *mariposæ,* measured by myself, in that the maximum length, width, and depth of bill of this lot of six specimens is but little greater than the minimum respective measurements of these parts in the other, and numerically larger, lots of breeding birds, while the coloration is about the same in all. In my judgment they are intergraded with *megarhyncha.*

In Swarth's list of specimens examined there is only one record of the Yakutat Fox Sparrow *(Passerella iliaca annectens)* from the Sacramento catchment basin, and that is from Tower House, Shasta County, 18 miles northwest of Redding, and there are only two other records given for the whole interior part of the state of California, one from Stockton, San Joaquin County, and one from Hume, Fresno County, although there are numerous records from on or near the coast. Of this race we secured three specimens, as stated above.

On the other hand, we took only one Valdez Fox Sparrow on this trip, although there are many records from both the coast country and the Sierras, with a few records from the Sacramento Valley proper.

On October 6 this field trip was concluded, and the return to San Francisco begun. Nothing of note was observed on the return trip except that there were swarms of small birds, of very common species, in the less elevated part of the open oak region just before the actual floor of the valley was reached, and in one place near this locality, a few miles northeast of Marysville, there were quite a number of Magpies *(Pica nuttalli nuttalli)*.

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V

OBSERVATIONS UPON THE BIRD LIFE OF DEATH VALLEY

(Contribution from the Museum of Vertebrate Zoology of the University of California)

BY

JOSEPH GRINNELL

It is customary to fix in more or less arbitrary fashion upon some definite limitation for any territory to be the subject of a faunal report. This is, as a rule, a necessary procedure; and political boundaries usually are chosen. In the present case the boundary selected is a natural one, namely, the topographic contour of sea-level; the field of observation concerned lies within the contour on the Ballarat and Furnace Creek sheets, United States Geological Survey, marked "00". No species whatsoever is dealt with that was not found in Death Valley below sea-level, that is, from 00 down to the lowest point, namely, about —280.

The observations here given first record were made during two stays in Death Valley, in April and May, 1917, and in April, 1920. In the first instance, the writer and Mr. Joseph Dixon, both of the staff of the California Museum of Vertebrate Zoology, entered the Valley by the way of the road down Furnace Creek Wash on April 2. The writer left on May 2, via Ryan; but Mr. Dixon was in the Valley at intervals until May 22, when he left by the Emigrant Canyon road. In 1920, the present writer, in company with Dr. Francis B. Sumner, of the

Scripps Institution for Biological Research, came into the Valley down the Emigrant Canyon road on April 2. And the two of us left on April 22, via the Furnace Creek Wash road. The first of these field trips was made possible through special gift of funds for the purpose by Miss Annie M. Alexander through the Museum of Vertebrate Zoology. The expenses of the second trip were met from funds supplied by Mr. E. W. Scripps through the Scripps Institution for Biological Research.

During the greater part of the time spent in Death Valley, headquarters were maintained at Greenland Ranch (Furnace Creek Ranch of the maps) where a bench-mark shows an altitude of —178 feet. Stations were also made for varying periods elsewhere in Death Valley as follows: Salt Creek, at the crossing of the "road", —200 feet, April 13-14 and May 19-22, 1917, and April 2-3, 1920; Triangle Spring, —13 feet, April 14-18, 1917; Eagle Borax Works, —250 feet, May 4-6 and May 17, 1917; "bad water" (of the Furnace Creek sheet, U.S.G.S.), about —280 feet, April 21-22, 1920. From each of these stations birds were looked for closely within a walking radius, which, however, under the conditions obtaining, seldom exceeded three miles.

In addition to these original sources, everything else I know of relative to the ornithology of the area in question is included in the present paper. Very important is the report upon the ornithology of The Death Valley Expedition of 1891 (A. K. Fisher, 1893). All the facts set forth in that publication, and of any definite bearing in the present study, are incorporated here. Also, in May, 1921, I took occasion to look up practically all of the specimens collected by that expedition in Death Valley, these specimens being contained in the Biological Survey collection, United States National Museum. It must be kept in mind that the limits here set (sea-level on all sides) rule out a number of the early "Death Valley" localities, such as Saratoga Springs, from which birds have been recorded.

Local aid has been received, which has contributed directly to the fullness of the account now offered. Lasting gratitude is due to Mr. Oscar A. Denton, foreman of Greenland Ranch, not only for the very many courtesies extended during the stays of myself and companions upon property under his charge, but also for information in regard to the animal life of the vicinity. Rarely have I met a man with such regard for accuracy of fact. I learned to place explicit reliance upon Mr. Denton's word, whenever he felt that he had grounds for expressing himself positively. Mr. Dane Coolidge, litterateur of Berkeley, who has visited Death Valley several times, has also contributed information of value. In all such cases, source is indicated. Otherwise it is to be understood that the specimens and original notes gathered by Mr. Dixon and myself, and forming the chief basis of the present report, are contained in the Museum of Vertebrate Zoology.

Opportunity is here taken to record the weights of a considerable number of birds. Comment will be found here and there in the annotations to species which goes to demonstrate the usefulness of weights, to at least as great degree as measurements, in distinguishing closely related forms. The weight is taken just before a bird is skinned, on a balance type of scales ("Cenco") reading to tenths of grams. In some cases colors of soft parts are given. Comparisons have then been made of the fresh specimen directly with the plates in Ridgway's "Color Standards" (1912).

The birds given formal entry in the accompanying annotated list number 124. The presence of each of these one or more times in the below-sea-level portion of Death Valley has been established on good evidence. Analysis of this list shows a constituency by seasonal categories which is much different from that usually obtaining in local lists; the proportion of breeding species to casual visitants, transients and winter visitants is exceedingly small.

There are 25 species out of the 124 which all the evidence at hand indicates to be but casual visitants, that is, vagrants of irregular or more or less unexpected appearance in the particular area under consideration. There are 45 species which are believed to be through and regular transients. There are 32 species which are winter visitants, though contingents of some of these are also transient, so that such species are far more commonly in evidence at migration time than in winter. There are but 10 species in the summer visitant category, and only one of these, the Bullock Oriole, is definitely known to breed in the below-sea-level area, and that one only on Furnace

Creek Ranch, where conditions are, in a sense, "artificial." The other nine species in this category breed in adjacent territory, and individuals "drop in" with more or less frequency.

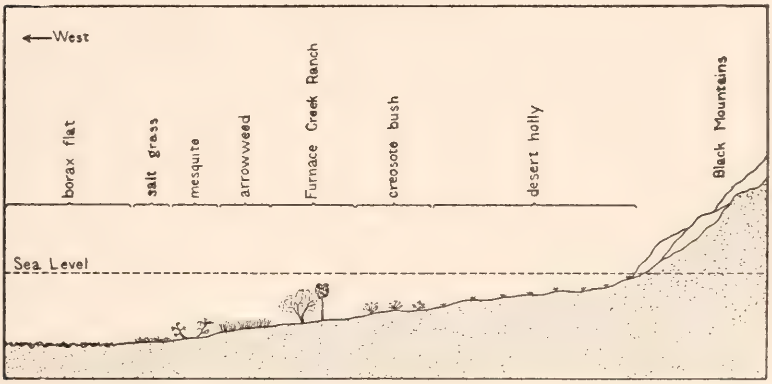
Finally, in the category of permanent residents there are only 12 species. All of these are believed to breed in the below-sea-level area. The following four are dependent on the existence of the Ranch: Killdeer, Desert Quail (introduced), Western Meadowlark, and English Sparrow (non-native). There are left but eight species which are native in, and doubtless breed "at large" in, the restricted area in question, namely: Prairie Falcon, Burrowing Owl, Road-runner, Say Phœbe, Western Raven, California Linnet, Leconte Thrasher, and Rock Wren.

Thus no more than 7 per cent of the total number of species of birds now known from Death Valley breed there outside of the precincts of Furnace Creek Ranch. The rest, 93 per cent, are transients, visitants or vagrants, or else owe their presence as breeders to the conditions developed by irrigation in the one small spot. Of course, the factor operating chiefly as cause of this situation is the lack of food accompanying the extreme type of desert condition prevalent. There are long stretches in the bottom of Death Valley that are to all appearance lifeless.

The associations (plant and animal) occurring in Death Valley may be designated as follows: tule, pickle-weed, salt grass, arrowweed, mesquite, æolian sand, creosote bush, desert holly (wash-fan), and rocky gorge. The "borax" flat proper, which occupies the lowest part of the floor of the valley, seems to be lifeless, at least as regards vertebrate animals, save incidentally as when birds and bats fly over it, or the larger mammals walk across it.

The accompanying conventionalized trans-section will give an idea of the associational relations obtaining as a usual thing up to sea-level. This diagram illustrates conditions in the vicinity of Furnace Creek Ranch; the associations not indicated thereon but mentioned above are of local occurrence elsewhere. The pickle-weed association is finely developed at Salt Creek. The æolian sand association recurs in a number of places, but reaches its greatest development at the south side of Mesquite Flat (see Ballarat sheet, U.S.G.S.). The tule association is represented in limited extent at some of the larger springs. For a discussion of the associational phase of avian distribution the reader is referred to a detailed treatment of the subject elsewhere (Grinnell, 1914).

Suffice it here to state that of all the associations above named as occurring in Death Valley the mesquite association is most prolific of bird life. The mesquite harbors an abundance of insects, its foliage is edible for some birds as are also the mesquite beans, and it affords shade and protective cover to a better degree than any other native plant of the region. Several of the associations named are, on the other hand, very lean as to bird constituents; in fact, in terms of experience in more attractive regions, some of them are sterile, save for vagrant birds which happen in only at long intervals.



Ideal sectional profile of Death Valley in the vicinity of Furnace Creek Ranch to show biotic associations.

At migration time, when birds of many kinds are traversing Death Valley in numbers, it is interesting to note how the individuals will "find themselves"associationally as nearly as existing conditions will permit. Associational choice is exercised just so far as is possible. For example, we find occasional Pipits on the sparse salt-grass patches, though no moisture may be in evidence on the surface of the ground. Savannah Sparrows and Marsh Wrens will be flushed from the pickle-weed, and tules. Black-throated and Nevada Sage Sparrows will be found on the wash-fans among the desert holly *(Atriplex hymenelytra)*. While the mesquites will harbor a variety of foliage feeders, such as the warblers, vireos, kinglets, and spizelline sparrows.

As to Furnace Creek Ranch itself, which comprises about sixty acres, all the acreage which can be kept productive with the amount of water available (some forty miner's inches), we find brought in by irrigation and cultivation a wide variety of non-native associational conditions. The chief of these are: small fugitive fresh-water ponds, running ditches with willows and other riparian growths, lush alfalfa and grain fields, Bermuda grass lawns, hedges of different plants, large cottonwood trees both living and dead, and some tall Washington palms. A considerable number of migrant and winter visitant birds tarry here and come to notice which would probably otherwise pass by overhead without ever alighting in Death Valley.

The ranch, sixty acres of vivid green, is located on the lower reaches of the debris fan which spreads out into the Valley from the mouth of Furnace Creek Wash. It is surrounded by vast desert of extreme type and offers in contrast a parallel to an island surrounded by the sea. For birds which affect green trees, rank grass and wet earth, Furnace Creek Ranch must serve as a beacon, visible and alluring from miles of passageway on either hand. Indeed, the ranch might well be likened to the famous Heligoland of the North Sea as a station from which to observe migration. Could it be made the base for continuous observation of birds throughout the entire year, and for a series of years, I venture to predict that quite as startling and significant findings would result as marked the work of Gätke on the island of Heligoland.

As is well known, migration comes to human attention chiefly through notice of the birds which stop over on the way; we do not ordinarily see the birds in actual passage. Death Valley is a north-and-south trough between high mountain ranges, the Amargosa Range on the east, 4000 to 7000 feet high, and the Panamint Range to the west, 5000 to 11,000 feet high. The Valley forms a natural channel for through migration. Thus Furnace Creek Ranch is a natural lodestone, pulling to itself from the migrant stream individuals or flocks now and then, day or night, and these may loiter a few minutes or a few hours, or even a few days, before resuming their journey. Again and again I had the experience of seeing a band of swallows, which migrate by day and not far above the ground, arrive from the south, wheel about a few times over the alfalfa, and then make off northwards.

All the water birds (ducks, snipe, etc.) which I saw coming to, or leaving, Furnace Creek Ranch in April pursued a course of migration up the Valley, paralleling its axis. This oasis is seemingly right in line with a migration route, which owes its location to circumstances in the general topographic configuration of the Inyo region.

As regards ducks, and water-birds in general, any little bit of open water constitutes a strong attraction to them. The irrigation ditches on the ranch, the grain and alfalfa fields when flooded, and the overflow or waste ditches which extend intermittently from the ranch down to, and even out onto, the "borax" flat, all serve to attract and hold for a time such migrants or vagrants as come within range of vision. From time immemorial the Indians have been in the habit of constructing artificial ponds with blinds close by from which to pot-shoot the birds. I was told that, until within a few years, the killing was done with bows and arrows. But now the Indians are all well provided with modern shot-guns. Even so, the Indians are not inclined to indulge in wing-shooting; in fact, I saw no instance of this. They prefer to do much stalking and patient waiting until several birds can be lined up on the water, sitting, and secured at one shot.

There are several ditches draining the Ranch on the west, and along each of these, in the midst of mesquite and arrowweed tracts, a little appropriate banking of the earth is done, and small ponds result in short order, in the course of whichever overflow ditch happens to be carrying the water. Often the brush is partially cleared so as to leave sight-ways from the places of concealment out to bits of open water. The "reservoir" at Furnace Creek Ranch, so frequently referred to in Fisher's Death Valley report of 1893, is not now in existence, nor has it been for many years.

Mr. Denton told me that there are many more ducks in evidence during the southward migration, in July and August, than when they are going north, in spring. There are then literally "thousands." The Indians are often able to get a "dozen at a shot" in the flooded alfalfa or on their shooting ponds.

It is perhaps needless to point out, but of course essential to keep in mind, that the floor of Death Valley is within the Lower Sonoran Life Zone. Furthermore, it is within the most arid division of that zone, namely, the Colorado Desert sub-faunal area, this diagnosis being based chiefly on the plants. It is, however, a detached portion of that sub-faunal area, being entirely surrounded by the Mohave Desert sub-faunal area. The yearly average rainfall according to the records kept at Furnace Creek Ranch is but half an inch. The lowest winter temperature recorded in a five-year yeriod (1912-1917) was 24° F; the highest summer temperature, 134°.

Death Valley offers a rare problem in distribution in that it suggests, zonally, a desert mountain range *inverted*. A low zone (in the bottom of the trough) is surrounded by a higher zone, instead of the reverse. While the bottom of Death Valley is below sea-level, the lowest place in the territory surrounding it is at an altitude of at least 2500 feet (as far as maps at hand indicate). In other words, it is at the bottom of a basin the lowest point in whose rim is at least 2500 feet above sea-level.

Even though Death Valley possesses many features seemingly attractive to bird-life of low Lower Sonoran, such, for instance, as fine tracts of mesquites, it lacks species of birds which are characteristic of the same sorts of places on the Colorado Desert; for example, the Abert Towhee, Lucy Warbler, Verdin, Plumbeous Gnatcatcher, and Crissal Thrasher. I believe these species *could* exist in Death Valley and would *be there* if they could have gotten there through the normal processes of gradual invasion. But the "Middle" Sonoran barrier has kept them out. Establishment in a new locality by the agency of vagrants is a relatively rare phenomenon.

If oscillations in general temperature conditions in recently past time, geologically speaking, had operated so as to elevate the life zones, and had thus permitted an extension of low Lower Sonoran (Colorado Desert sub-faunal division) continuously *north*wards over the intervening divides, *with subsequent zonal lowering,* then a representation of that sub-fauna would have been left stranded in Death Valley, just as northern types have been left stranded on southern mountain tops with the rising of the life-zones. But I know of no good evidence to show that there has been any *lowering* of life zones in this region within or since Pleistocene times; there has been only a gradual *rising* of them. The trough of Death Valley has received into its avifauna only the hardier Lower Sonoran species, like the Leconte Thrasher and Road-runner, which have a wide vertical range anyway.

It is believed that the best way of conveying definite information as to the relative abundance of species is by citing actual censuses. The following selections are therefore put on record here. They are all from my own notebook, each entry there being based on a pencil-checked memorandum covering a given period of time over a stated route.

West base of Black Mountains at lowest point in Death Valley (about —280 feet), close to "bad water" of U.S.G.S. map; rocky gorges, cliffs, desert holly wash-fans, and sparse pickle-weed at edge of "borax" flat; April 21, 1920, 3:00 to 5:30 p.m.; day quiet and pleasantly warm. Prairie Falcon 1, Say Phœbe 1, Western Raven 2, Black-throated Sparrow 1, Rock Wren 1. Total, 5 species, 6 individuals, in 2½ hours of close search over a two-mile strip paralleling the "sump".

Vicinity of Black Point, near B.M. —223, six miles south of Furnace Creek Ranch, and up adjacent canyons in the west base of the Black Mountains to sea-level; associations, salt grass at edge of "borax" flat, desert holly wash-fan, and rocky gorge; April 11, 1920, 9:00 to 11:30 a.m.; the day quiet and very warm. Say Phœbe 1, Horned Lark 1, Western Raven 1, California Linnet 6, Rock Wren 1. Total, 5 species, 10 individuals, in 2½ hours.

Triangle Spring, —13 feet, and within radius of one mile; association chiefly sparse mesquite and desert holly; April 17, 1917, 5:15 to 7:30 a.m.; the day cool, east wind. Sharp-shinned Hawk 1, Sparrow Hawk 1, Costa Hummingbird 1, Say Phœbe 4, Western Raven 1, California Linnet 6, Brewer Sparrow 10. Total, 7 species, 24 individuals, in 2¼ hours.

Salt Creek, —200 feet, mostly on or close to the marshy ground (salt grass, pickle-weed, cane), but partly in mesquite thickets; April 14, 1917, 5:00 to 9:00 a.m.; the day pleasant;

number of miles covered all told, not over four. Wilson Snipe 1, Western Raven 2, Brewer Blackbird 1, California Linnet 15+, Savannah Sparrow 6, Intermediate White-crowned Sparrow 10±, Brewer Sparrow 6, Audubon Warbler 4, American Pipit 4, Western Mockingbird 1, Western Marsh Wren 2. Total, 11 species, 52 individuals, in 4 hours.

West of Furnace Creek Ranch, —178 down to —250 feet, altogether off the ranch, chiefly in mesquite association; April 3, 1917, 7:30 to 10:00 a.m.; the day quiet, warm; number of miles covered, close to five. Turkey Vulture 4, Sparrow Hawk 1, Say Phœbe 4, Western Raven 1, Western Meadowlark 1, California Linnet 2, Intermediate White-crowned Sparrow 1, Brewer Sparrow 6, American Pipit 1, Leconte Thrasher 1. Total, 10 species, 22 individuals, in 2½ hours.

North and west of Furnace Creek Ranch, —178 down to —250 feet, altogether off the Ranch but within two-mile radius of it; chiefly in mesquite and arrowweed associations along overflow streamlets; April 26, 1917, 7:40 to 9:40 a.m.; day quiet and warm. American Bittern 1, Killdeer 3, Mourning Dove 1, Turkey Vulture 1, Western Kingbird 3, Ash-throated Flycatcher 1, Say Phœbe 1, Gray Flycatcher 2, Western Raven 1, Bullock Oriole 1, Brewer Blackbird 2, California Linnet 1, Green-backed Goldfinch 2, Intermediate White-crowned Sparrow 4, Brewer Sparrow 110±, Western Chipping Sparrow 4, Rough-winged Swallow 3, Audubon Warbler 8, Leconte Thrasher 2, unknown 3. Total, 19 species, 154 individuals, in 2 hours (but 110 of these were of one species).

South of Furnace Creek Ranch within three-mile radius, about —200 feet up to near sea-level, altogether off the Ranch; associations mostly mesquite, sand-dune, creosote, desert holly, and rocky gorge; April 7, 1920, 6:30 to 10:45 a.m.; the day quiet and pleasantly warm. California Linnet 4, Western Chipping Sparrow 1, Brewer Sparrow 6, Desert Black-throated Sparrow 2, White-rumped Shrike 1, Audubon Warbler 4, Sage Thrasher 7, Leconte Thrasher 5, Rock Wren 4, Western Robin 1. Total, 10 species, 35 individuals, in 4¼ hours (on the desert entirely away from the influence of the Ranch).

Furnace Creek Ranch proper, and also tracts of mesquite and arrowweed immediately to the west, —178 down to —200 feet; April 16, 1920, 6:00 to 9:00 a.m.; the day partly cloudy,

comfortably cool, variable winds. Wilson Snipe 3, Desert Quail 1, Mourning Dove 6, Sharp-shinned Hawk 1, Red-shafted Flicker 2, White-throated Swift 2, Gray Flycatcher 2, Vermilion Flycatcher 2, Red-winged Blackbird 2, Western Meadowlark 12, Bullock Oriole 2, Green-backed Goldfinch 2, Savannah Sparrow (subsp.?) 8, Western Lark Sparrow 2, English Sparrow 16±, Intermediate White-crowned Sparrow 10, Western Chipping Sparrow 4, Brewer Sparrow 44±, Lincoln Sparrow 4, Barn Swallow 2, Tree Swallow 3, Rough-winged Swallow 3, Audubon Warbler 25±, Western Yellow-throat 1, American Pipit 2, Western Mockingbird 1, Leconte Thrasher 2, Western Marsh Wren 1, Ruby-crowned Kinglet 2, Western Gnatcatcher 3, Western Robin 6. Total, 31 species, 176 individuals, in 3 hours.

Furnace Creek Ranch, —178 feet, entirely within the outer fences bounding the ranch; April 23, 1917, 6:30 to 8:30 a.m.; the day warm, light south wind; approximate number of miles covered in walking, four. Mourning Dove 2, Costa Hummingbird 1, Western Kingbird 3, Western Raven 1, Yellow-headed Blackbird 12, Red-winged Blackbird 12±, Western Meadowlark 12, Bullock Oriole 6, California Linnet 3, Green-backed Goldfinch 5, Western Vesper Sparrow 6, Savannah Sparrow (both subsp.) 17±, Western Lark Sparrow 1, English Sparrow 16±, Intermediate White-crowned Sparrow 4, Brewer Sparrow 4, Violet-green Swallow 18±, Rough-winged Swallow 2, Cassin Vireo 1, Audubon Warbler 2, American Pipit 2, Western House Wren 1, Ruby-crowned Kinglet 1, Western Robin 4. Total, 24 species, 136 individuals, checked in two hours; this is 2 per acre, *on the ranch*.

Furnace Creek Ranch and the tracts of mesquite and arrow-weed to the west almost down to the "borax" flat, —175 down to —200 feet; April 19, 1920, 6:00 to 9:00 a.m.; the day clear, quiet, and pleasantly warm. Cinnamon Teal 6, Mud-hen 1, Wilson Snipe 5, Killdeer 4, Desert Quail 1, Mourning Dove 3, Cooper Hawk 2, Swainson Hawk 6, Prairie Falcon 1, Red-shafted Flicker 2, Texas Nighthawk 2, White-throated Swift 9+, Western Kingbird 1, Western Raven 4, Red-winged Blackbird 24±, Western Meadowlark 10+, Bullock Oriole 6, Brewer Blackbird 2, California Linnet 2, Green-backed Goldfinch 1, Savannah Sparrow (subsp.?) 2, English Sparrow

12+, Intermediate White-crowned Sparrow 7+, Western Chipping Sparrow 2, Brewer Sparrow 25±, Lincoln Sparrow 1, Rough-winged Swallow 1, Audubon Warbler 17±, American Pipit 50±, Leconte Thrasher 1, Ruby-crowned Kinglet 3, Western Gnatcatcher 2, Western Robin 17±. Total, 33 species, 232 individuals, in 3 hours, covering about five miles of route and an area of about one square mile; the biggest census obtained in Death Valley (weather conditions excellent and migrants numerous).

1. **Colymbus nigricollis californicus** (Heermann).

American Eared Grebe.

But one record: A specimen taken in 1891 "on the reservoir at Furnace Creek" Ranch, either April 11 (Fisher, 1893, p. 13) or April 10 (loc. cit., p. 150).

2. **Podilymbus podiceps** (Linnæus). Pied-billed Grebe.

Presence ascertained twice, on April 7 and April 25, 1917. On the first date an Indian who was irrigating the alfalfa on Furnace Creek Ranch picked up two from a ditch where the birds were unable to escape by diving nor yet seemed able to get under way in flight. The two proved to be of opposite sex, and were thought to have arrived during the preceding night—a mated pair, perhaps, migrating together. On the second date a female was shot from a duck pond in the arrowweeds below the ranch.

Three specimens preserved, nos. 27802, ♂, 27803, ♀, 28867, ♀; weights, respectively, 452.5, 373.0, and 304.5 grams; not fat.

3. **Anas platyrhynchos** Linnæus. Mallard.

One record: Adult male taken at an irrigating ditch on Furnace Creek Ranch, January 23, 1891 (Fisher, 1893, pp. 15, 150).

4. **Mareca americana** (Gmelin). Baldpate.

At daybreak on April 5, 1917, a flock of twelve was discovered "puddling" in a flooded alfalfa patch on Furnace Creek Ranch. Five were shot and two of these preserved:

Nos. 27804, ♂, 27805, ♂; weights, 641 and 656 grams, respectively; not especially fat.

A female seen flying overhead on April 20, 1920.

In 1891, secured at Furnace Creek Ranch on April 8 and "in January" (Fisher, 1893, pp. 16, 150).

5. **Nettion carolinense** (Gmelin). Green-winged Teal.

One lone individual flushed from overflow ditch just below Furnace Creek Ranch, April 28, 1917; shot, and preserved: No. 27806, ♂; weight 355.5 grams.

Two seen at the ranch by Mr. Dane Coolidge late in December, 1919.

Found January 23 to February 4, 1891, at Furnace Creek Ranch, where small flocks were to be seen either on the reservoir or in the irrigating ditches (Fisher, 1893, pp. 16, 150).

6. **Querquedula cyanoptera** (Vieillot). Cinnamon Teal.

The most frequent duck in Death Valley during the spring months; likely to put in an appearance at any little pond or ditch.

In 1891, flocks were seen at Furnace Creek Ranch in March, and a non-breeding female was secured on the reservoir there, June 19 (Fisher, 1893, pp. 17, 150).

In 1917, noted at Furnace Creek Ranch as follows: April 5, seven at daybreak in flooded alfalfa field, and later a company of ten seen; April 24, three on Indian-made pond in arrowweeds below the ranch; April 28, one in same place; April 29, three flushed from irrigation ditch. In 1920: April 6, flock of about fifteen at artificial pond below the ranch; April 10, one lone male flushed from ditch; April 13, ten flushed from shallow overflow surrounded by arrowweed; April 16, four on flooded grain-field; April 19, two bunches of four, on a little pond, and on overflow from drainage ditch down in the mesquites; April 20, three on overflow ditch.

The ducks appeared to arrive mostly, if not altogether, at night, and seemed loath to leave the vicinity during the daytime. The Indians were accustomed to stalk them from place to place, so that sometimes all or most of a company present early in the morning had been shot by night. Needless to say, game laws and game law enforcement are so far unknown in this remote section of the country.

At Eagle Borax Works, on May 5, 1917, Mr. Dixon saw some Cinnamon Teal feeding on a pond at the lower edge of the marsh; and on May 17, the same year, he flushed a pair there.

Specimens were taken, all at Furnace Creek Ranch, as follows: No. 27810, ♂, April 27, weight 301.3 grams; no. 27808, ♂, April 24, 290.0 grams; no. 27807, ♂, April 5, 320 grams (gullet full of earthworms); no. 27809, ♀, April 24, 305.7 grams; no. 40526, ♂, April 13, 400 grams. The first four were secured in 1917, the last one in 1920.

7. **Spatula clypeata** (Linnæus). Shoveller.

In 1917 one was seen on Furnace Creek Ranch in irrigated alfalfa at daybreak of April 5. A Shoveller was killed by Mr. Denton on the ranch the last of December, 1919.

In 1891, a flock of four was seen on the reservoir at Furnace Creek Ranch "the latter part of January" (Fisher, 1893, pp. 17, 150).

8. **Dafila acuta** (Linnæus). Pintail.

On May 3, 1917, on Furnace Creek Ranch, three females and one male were reported seen, and a pair which had been shot by some one was examined by Mr. Dixon.

9. **Marila affinis** (Eyton). Lesser Scaup Duck.

Mr. Dane Coolidge reports seeing seven "blue-bills" in a flock on Furnace Creek Ranch December 29, 1919. One of these was shot by Mr. Denton.

10. **Erismatura jamaicensis** (Gmelin). Ruddy Duck.

Three examples were secured on the reservoir at Furnace Creek Ranch, March 22, 1891 (Fisher, 1893, pp. 18, 150).

11. **Anser albifrons albifrons** (Scopoli). White-fronted Goose.

One individual remained several days in the alfalfa field at Furnace Creek Ranch during the latter part of March, 1891 (Fisher, 1893, pp. 18, 150).

12. **Branta canadensis** (Linnæus). Canada Goose.

One killed at Furnace Creek Ranch by an Indian December 24, 1919. Another seen by Mr. Dane Coolidge to alight in a field on the ranch December 29 the same year. Four Canada Geese were seen for several days in the latter part of March, 1891, about the alfalfa field at Furnace Creek Ranch (Fisher, 1893, pp. 19, 150). Subspecies not determined in any of these cases.

13. **Plegadis guarauna** (Linnæus). White-faced Glossy Ibis.

A single one was secured by Mr. Dixon in the marsh at Eagle Borax Works, —260 feet altitude, May 17, 1917. It had been shot through the bill at some fairly recent time and this may be the reason for its having remained behind its migrating fellows. The specimen was preserved: No. 27812, ♀; weight 386 grams.

Mr. Denton reported that a flock of about one hundred stopped at Furnace Creek Ranch on May 7, 1917.

The remains of a specimen killed at Furnace Creek Ranch in 1891 were examined by Dr. A. K. Fisher (1893, pp. 19, 150).

14. **Botaurus lentiginosus** (Montagu). American Bittern.

On April 26, 1917, one was flushed from an arrowweed thicket bordering an overflow ditch down towards the flat from Furnace Creek Ranch. It was shot: No. 27813, ♀; weight 475 grams. On April 30 the same year a Bittern was routed out from beneath a mesquite near the overflow stream due west of the ranch, close to the edge of the "borax" flat, —250 feet altitude. On April 15, 1920, one was captured by an Indian in an irrigation ditch on the ranch.

15. **Ardea herodias treganzai** Court. Pallid Great Blue Heron.

At Furnace Creek Ranch, April 25, 1917, one was seen at 5 a.m. flying overhead croaking hoarsely. It finally settled at a pond in the arrowweeds, but on alarm flew off north. On April 28 the same year one was flushed from a pond at the ranch.

16. **Nycticorax nycticorax nævius** (Boddaert).

Black-crowned Night Heron.

On April 19 and 20, 1917, at least two individuals appeared along the main ditch at Furnace Creek Ranch. One was shot on April 20: No. 27814, ♂; weight, 580 grams. An immature individual was shot at Furnace Creek Ranch June 19, 1891 (Fisher, 1893, pp. 20, 150).

17. **Porzana carolina** (Linnæus). Sora Rail.

On May 17, 1917, one was flushed by Mr. Dixon from the marsh at the Eagle Borax Works, —260 feet altitude. It was blown violently to the ground by the wind, where it was shot: No. 27816, ♀; weight 48 grams.

18. **Fulica americana** Gmelin. Mud-hen.

On April 4, 1917, and for a week previously according to report, one was seen in the immediate ranch yard at Furnace Creek Ranch, where it commingled with the chickens. In April, 1920 (from the 14th to the 19th), a lone Coot was seen repeatedly along the ditches on the ranch. When pursued it proved expert in hiding in the lush alfalfa of the adjacent fields.

19. **Steganopus tricolor** Vieillot. Wilson Phalarope.

One record: an adult male shot "near the overflow of a ditch in the alfalfa field" at Furnace Creek Ranch, June 19, 1891 (Fisher, 1893, pp. 22, 150).

20. **Recurvirostra americana** Gmelin. American Avocet.

On April 20, 1920, two in high plumage were met with on the main overflow ditch to the west of Furnace Creek Ranch down towards the "borax" flat. One collected: No. 40527, ♂; weight, 383 grams; bill and claws black; feet and legs pearl blue; iris deep hazel.

21. **Gallinago delicata** (Ord). Wilson Snipe.

Present on Furnace Creek Ranch at frequent intervals during the month of April in both 1917 and 1920. From one to twelve would be encountered in a morning's ransacking of all appropriate places about the ranch. The snipe evidently arrived during the night, and were loath to leave the ranch during the daytime, even when followed about and flushed over and over again. Some days none at all could be found. Sure signs of their presence were the probe-holes in the soft wet bottoms of irrigation ditches from which the water had just been turned onto the alfalfa. Such ditches would seem to have been sought by the birds with remarkable directness. Not only the irrigation ditches on the ranch proper were favorable for snipe, but also the edges of the overflow ditches to the west of, and below, the ranch. Here, instead of alfalfa, the vegetation consisted of arrowweed, mesquite, and some Bermuda grass and salt-grass.

In 1917, Wilson Snipe were observed around Furnace Creek Ranch from April 3 (two) to April 29 (one), the greatest number ("about 12") on April 5; in 1920 from April 4 (one) to April 20 (four), the greatest number (eight) on April 9.

One specimen taken: No. 40528, ♀, April 5, 1920; weight, 111.9 grams.

In 1891, one was seen on the ranch April 11 (Fisher, 1893, pp. 22, 150). Mr. Dane Coolidge found one on the ranch December 30, 1919, which indicates wintering of the species in Death Valley. On April 14, 1917, I flushed one from the pickle-weed bordering Salt Creek, —200 feet altitude.

22. **Tringa solitaria cinnamomea** (Brewster).

Western Solitary Sandpiper.

One met with by me on Furnace Creek Ranch, April 20, 1920; first flushed from an overflow pool down in mesquites, but later seen to alight in a flooded grain field, whence secured: No. 40529, ♂; weight, 50 grams; feet and legs grape green; bill at base the same, becoming black on terminal half; iris bister; wing, 131.8 mm.; culmen, 29.0; tarsus, 32.3. This specimen is not, in the characters of coloration given by Ridgway (1919, p. 363), very emphatically *cinnamomea;* in measurements, however, it is nearer that race than *solitaria,* on the basis of Ridgway's averages.

23. **Oxyechus vociferus vociferus** (Linnæus). North American Killdeer.

Noted almost daily on Furnace Creek Ranch. In 1917 seen from April 5 (six in early morning) to April 29 (two); in 1920 from April 4 (two) to April 20 (four). Never more than six noted on the ranch at one time, usually but two or only one. Showed preference for newly-planted fields, or newly-mown ones, where, when flooded, the water was shallow and open. Also frequented the edges of the overflows down clear to the borax flat, —250 feet altitude, west of the ranch. On April 10, 1920, for instance, two Killdeer were foraging there, on the very floor of Death Valley, with the glaring white alkali on all sides.

One specimen taken: No. 27830, ♂, April 5, 1917; weight, 85.5 grams. No evidence of nesting observed by me.

Heard at Salt Creek, —200 feet, April 14, 1917, and April 3, 1920; that is, heard during the nights preceding the days of these dates.

In 1891, found at Furnace Creek Ranch "in the latter part of January," "about the middle of April," and "June 19-22"; "not uncommon"; "breeds" (Fisher, 1893, pp. 24, 150).

24. **Lophortyx gambelii gambelii** Gambel. Desert Quail.

Seen only in the near vicinity of Furnace Creek Ranch. There were probably close to a dozen pairs there in April, 1917; but three years later I found evidence of the presence of no more than three pairs. Mr. Denton believed there had been as many as seventy-five around the ranch in the fall of some years. He further thought that the shotgun was the chief factor against the quail. However, the fact the Desert Quail are not native in Death Valley may point towards the existence of some natural condition there unfavorable to them.

One specimen taken: No. 27845, ♂, April 22, 1917; weight, 161.8 grams; crop filled with a mixture of green mesquite-blossom buds and fœces of *Ammospermophilus*. I am unable to find any significant differences between this example and other specimens of similar season from the Colorado Desert.

In 1891, "common" at Furnace Creek Ranch. " . . . Reported to have been introduced by the Borax Company from Resting Springs", in the Amargosa Valley (Fisher, 1893, pp. 29, 150).

25. **Zenaidura macroura marginella** (Woodhouse).

Western Mourning Dove.

Mr. Denton says doves are abundant all summer on Furnace Creek Ranch, departing early in the fall. In 1917 the first seen by Mr. Dixon and myself, one pair, were noted on April 10; in 1920 the first seen, a lone bird, was noted by me on April 4. In each year, after their first appearance, doves were seen almost daily. In the usual two- or three-hour census on and about the ranch, from two to four doves would be checked. The greatest number for one day was twelve in one flock, and fully a dozen others seen singly or in pairs, on April 29, 1917. A gradual increase in numbers through April is indicated by the censuses. On May 4, 1917, doves were thought to be more plentiful than previously that year, though no actual count was made.

Doves were seen to arrive at the ranch from the south, and it is probable that some of the population was continually shifting. While some doubtless nested in the near vicinity of Death Valley, we found no definite evidence of their doing so in the below-sea-level area.

The doves resorted to the ditch sides and overflow ponds to drink, to the dry weedy margins of fields and the stubble to feed, and to the lower branches of the green-crowned cottonwoods to "coo."

Two specimens taken: No. 27847, ♂, April 10, 1917, weight 121 grams; no. 27848, ♀, April 25, 1917, weight 105.1 grams.

In 1891, a single individual was found at Furnace Creek Ranch "the latter part of January". Migrants first observed at this point April 9-12, and four seen here June 19-21 (Fisher, 1893, pp. 33, 150).

26. **Cathartes aura septentrionalis** Wied.

North American Turkey Vulture.

Of frequent note around Furnace Creek Ranch during April. In 1917, seen from April 3 to 26, inclusive; in 1920 from April 4 to 17. The most observed in one census was 6 in three hours, on April 11, 1917; the recent deposit of a dead calf on the "dump" out on the desert south of the ranch accounted for this assemblage. Usually but one or two would be seen in a day, in overhead flight. On the evening of April 15, 1920, during a gale, a buzzard took refuge in a cottonwood on the ranch, perching low in the tree.

In 1891, several were seen at Furnace Creek Ranch on April 11, and some were seen there June 19-21 (Fisher, 1893, pp. 34, 150).

27. **Circus hudsonius** (Linnæus). Marsh Hawk.

Seen at Furnace Creek Ranch April 3 and 9, 1917, one individual on each date. The one on the first occasion was secured: No. 27849, ♂ adult; weight, 371 grams; fat. This bird was shot by Mr. Dixon when it was trying to catch a Desert Quail. Repeated short swoops were made at the quail, which had sought refuge in a mesquite bush. Mr. Dixon had no doubt but that the latter would have been caught, had it not been for the protection afforded by the bush. The stomach of the hawk contained only a little mouse fur.

On April 3, 1920, at Salt Creek, —200 feet, a Marsh Hawk flew by, going north.

In 1891, an "adult male was secured at Furnace Creek" Ranch, January 29 (Fisher, 1893, pp. 35, 150).

28. **Accipiter velox** (Wilson). Sharp-shinned Hawk.

Noted at Furnace Creek Ranch April 7 and 20, 1917, and April 4 and 16, 1920; one bird in each case. Two shot, on the first two stated dates: No. 27850, ♀ adult, weight 177 grams, unidentified feathers in stomach; no. 27851, ♂ adult, weight 106.5 grams, gullet contained finely cut-up remains of Brewer Sparrow.

Noted at Triangle Spring, —13 feet, April 15 and 17, 1917, one bird each time. These hawks are prone to hang about springs in desert regions, where, of course, they find easy picking among the small birds that must come to drink.

In 1891, two were seen at Furnace Creek Ranch "in the latter part of January" and one at Bennett Wells at "about the same time"; also two were seen at Furnace Creek Ranch, April 11 (Fisher, 1893, pp. 35, 150).

29. **Accipiter cooperii** (Bonaparte). Cooper Hawk.

Observed at Furnace Creek Ranch April 10, 22 and 30, 1917, and April 18, 19 and 20, 1920; one bird in each case except on the 19th, when what were believed to be three different individuals were checked during a three-hour morning's census. Nearly all of these hawks were seen in or near the lines of large mesquites within a mile west of the ranch proper.

Two specimens taken: No. 27854, ♀ adult, April 10, 1917; weight 451 grams; gullet contained finely cut-up remains of a Desert Antelope Ground Squirrel *(Ammospermophilus leucurus leucurus)*; most of bones and skin excluded, though both hind feet were present entire. No. 40531, ♀ adult, April 19, 1920; weight 460 grams, net; crop contents weighed 64.3 grams; this consisted of a Desert Wood Rat *(Neotoma intermedia desertorum)*—mostly carefully picked pieces of clean meat, but also the tail entire, both hind feet, one testicle, and the skin of the head inside-out. Neither of these hawks showed evidences of near approach of the breeding season; probably transients.

In 1891, "one or two" were seen at Furnace Creek Ranch in the latter part of January (Fisher, 1893, pp. 36, 150).

30. **Buteo borealis calurus** Cassin.

Western Red-tailed Hawk.

In 1891, one was seen at Bennett Wells on June 21, and between Bennett Wells and Saratoga Springs several were observed about the first of February; also seen at Furnace Creek Ranch in January (Fisher, 1893, pp. 37, 150). Not observed anywhere below sea level in 1917 or 1920, though noted in nearby localities.

31. **Buteo swainsoni** Bonaparte. Swainson Hawk.

Noted only in the neighborhood af Furnace Creek Ranch. One shot on May 3, 1917: No. 27860, ♂; weight, 700 grams. On April 18, 1920, one appeared over the ranch at 7 a.m., tacking back and forth against the howling north gale. The next day, the wind having ceased, six different individuals were checked in a three-hour forenoon's circuit over the territory within two miles west and south of the ranch. Most of these birds were circling or in flight towards the northwest; one was perched on a low mesquite stub near the edge of the borax flat, about —250 feet.

32. **Falco mexicanus** Schlegel. Prairie Falcon.

At Furnace Creek Ranch on April 19, 1920, one was seen to dash down into a grain field and secure in its talons a Meadowlark, making off with it at a level height of 25 feet or so. As it flew I saw it reach down with its bill and pick at the bird in its claws, at the same time appearing to shift its hold on the bird, which was seen to struggle slightly.

On the east side of "bad water" (of the map), about —280 feet, on April 21, 1920, a Prairie Falcon flew close by me along the precipitous face of the mountain.

In 1891 one was seen January 22 between Bennett Wells and Furnace Creek Ranch; "at the latter place one was shot from its perch on a haystack" January 27. Also one was seen at Furnace Creek Ranch on June 20 (Fisher, 1893, pp. 39, 150).

33. **Falco columbarius** Linnæus. Pigeon Hawk.

One record: the remains of one were found near the reservoir at Furnace Creek Ranch, June 21, 1891 (Fisher, 1893, pp. 40, 150). A primary and two rectrices from the remains are preserved in the Biological Survey collection and have been examined by me.

34. **Falco sparverius sparverius** Linnæus.
American Sparrow Hawk.

Seen frequently on or near Furnace Creek Ranch, one or two in a day. A favorite perch was the highest point on the hay derrick. Noted April 3, 4, 6, 10, 11, 21, 22 and 29, 1917, and April 10, 11 and 20, 1920. Five specimens taken: Nos. 27862-65, 40532, all females; weights, 115.5, 106.5, 94.7, 86.0, 82.5 grams, respectively. These skins do not seem to differ in any tangible way from skins of corresponding season taken in west-central California; likely transients in the Death Valley region.

Observed on Mesquite Flat in the vicinity of Triangle Spring, —13 feet, April 15, 16 and 17, 1917, six individual birds all told. On the 16th two Sparrow Hawks were met with, perching on small rocks far out on the level floor of the Flat, nearby to the sand-dunes; they were absolutely the only birds seen during an hour's tramp over that sort of ground.

In 1891, seen at Mesquite Well January 21, at Bennett Wells on the same date and again about the middle of April, at Furnace Creek Ranch March 22, and in Mesquite Valley [Flat] April 12 (Fisher, 1893, pp. 40, 151).

35. **Pandion haliaëtus carolinensis** (Gmelin).

American Osprey.

At Furnace Creek Ranch on April 28, 1917, one perched for a time about sundown on the masthead of the hoist at the haystack. It was poising against the north gale, and kept calling in characteristic fashion.

In 1891, a single individual was seen at Furnace Creek Ranch "just before dark on April 10." Also the remains of one were noted nailed upon the side of the house at the ranch, where it had been killed a year or so previously (Fisher, 1893, pp. 41, 151).

36. **Speotyto cunicularia hypogæa** (Bonaparte).

North American Burrowing Owl.

On April 13, 1917, a pair was found about five miles north of Furnace Creek Ranch, close to B. M. —253. Their burrow (probably belonging originally to a Desert Kangaroo Rat) was at the edge of a wash where hard ground met the alkali. When alarmed, one owl flew far away over the desert and the other disappeared down the burrow, both thus playing safe.

Some pellets from the mound at the mouth of the burrow showed insect remains.

In 1891, a pair of Burrowing Owls was seen at Bennett Wells on June 21 (Fisher, 1893, pp. 44, 151).

37. **Geococcyx californianus** (Lesson). Road-runner.

One was heard "singing" near Furnace Creek Ranch on April 4, 1917; and on the 6th, tracks were seen in the sand among the mesquites southwest of the ranch. On April 18, 1917, similar evidence was noted near Triangle Spring, —13 feet.

In 1891, numerous tracks were seen around the mesquite and other thick growths at Furnace Creek Ranch in both January and June (Fisher, 1893, pp. 45, 151).

38. **Coccyzus americanus occidentalis** Ridgway.

California Cuckoo.

One record: on June 20, 1891, a single individual was seen about sunrise at Furnace Creek Ranch among the willows at the edge of the reservoir; later in the day it was secured, proving to be an adult female (Fisher, 1893, pp. 45, 151). This specimen is No. 142325, Biol. Surv. coll., U. S. Nat. Mus.

39. **Ceryle alcyon caurina** Grinnell.

Northwestern Belted Kingfisher.

Transient. Observed along the main ditch on Furnace Creek Ranch, April 4, 7, 9, 20 and 21, 1917. One shot at daybreak of the 7th from a dead cottonwood: No. 27890, ♂; weight 150 grams. This specimen is not good *caurina,* as represented on the southeastern coast of Alaska. In fact, it is not separable from some examples of *alcyon* at hand, and it is placed with *caurina* only on geographical grounds.

In 1891, one was reported at Furnace Creek Ranch, flying about the reservoir there, April 15 (Fisher, 1893, pp. 46, 151).

40. **Colaptes auratus luteus** Bangs.

Northern Yellow-shafted Flicker.

On Furnace Creek Ranch, April 12, 1917, a plainly yellow "shafted" Flicker was seen coming in undulating flight across the alfalfa fields, and presently it lit on a fence post within shotgun range of me and was secured: No. 27901, ♂; weight, 119.2 grams; wing, 157.8 mm.; tail, 102.7; tarsus, 28.2; culmen, 32.1.

This specimen is, in coloration, pure *auratus* in every respect —not a trace of *cafer* "blood". As to size, it falls with the average of dimensions of *luteus,* as given by Ridgway (1914, p. 18), certainly not with *borealis. Borealis* has been ascribed to California; but actual specimens of good *auratus* have not been critically compared hitherto by the present writer. It may be that all are *luteus.* At any rate, the present Death Valley example must be considered *luteus,* and on this definite basis this subspecies is to be ascribed to California.

41. **Colaptes cafer collaris** Vigors. Red-shafted Flicker.

In 1917 relatively scarce on Furnace Creek Ranch. Either one or two birds, only, noted on April 6, 9, 10, 11 and 28. But in 1920 noted almost daily from April 4 to April 19, two individuals on the first and last dates and up to six present in one day on intermediate dates. The Flickers adhered pretty closely to the ranch domain, where they would be seen in or near the cottonwoods and willows along the ditches, or on the posts of the fences between the fields. One specimen taken: No. 27902, ♀; April 28, 1917; weight, 132.7 grams.

In December, 1919, Mr. Dane Coolidge found a Flicker sleeping regularly in one of the fan palms at the ranch, and it was also seen several times about the woodpiles where it was thought to be feeding upon the grubs in the mesquite logs.

In 1891, one individual was seen among the willows and mesquites at Furnace Creek Ranch on April 10 (Fisher, 1893, pp. 51, 151).

42. **Phalænoptilus nuttallii nuttallii** (Audubon).

Nuttall Poor-will.

Noted on Furnace Creek Ranch in 1917 on April 3, 4, 11 and 22; in 1920 on April 7 and 11. Appeared at late dusk flying low over alfalfa or alighting on bare ground around the "weevily" woodpile. Not more than one observed on any one evening.

Three examples secured, on April 3, 11 and 22, 1917, respectively: No. 27909, ♂, weight 31.5 grams, wing 139.8 mm.; no. 27910, ♀, weight 45.2 grams, wing 136.1 mm.; no. 27911, ♂, weight 40.2 grams, wing 140.3 mm. By coloration and wing-length these specimens fall in with *P. n. nuttallii*, rather than with *P. n. nitidus* (see Grinnell, 1914, pp. 141-142). In each bird the reproductive organs showed small degree of development, so all were likely migrants destined to breed in regions to the north of the general region of Death Valley or else at much higher levels in the mountains adjacent.

In 1891, a specimen was obtained at Bennett Wells January 28, and the species was seen and heard at Furnace Creek Ranch April 10 and in Mesquite Valley [Flat] April 13 (Fisher, 1893, pp. 51, 52, 151). The Bennett Wells specimen is a female, no. 140364, Biol. Surv. coll., U. S. Nat. Mus.; its wing measures 151.0 mm., indicating an extra large individual of *nuttallii*.

43. **Chordeiles minor hesperis** Grinnell. Pacific Nighthawk.

One record: specimen secured at Furnace Creek Ranch, June 19, 1891 (Fisher, 1893, pp. 53, 151). Originally reported under the name *henryi*, but later determined to be *hesperis* (see Oberholser, 1914, p. 50).

44. **Chordeiles acutipennis texensis** Lawrence.

Texas Nighthawk.

Appeared at dusk over the green fields of Furnace Creek Ranch quite regularly save when a gale was blowing. Was already present on the evening of April 2, 1917, the date of my first arrival on the ranch. From two to six would be seen in an evening; the latter number was checked on April 26,

1917. Whenever chance offered, the birds were closely scrutinized as to position of the white patch on the wing, so as to be sure of differentiation of *texensis* from *hesperis*.

The only time the Texas Nighthawk was seen on the open desert was on April 19, 1920, some two miles southwest of the ranch, —250 feet altitude. There, about 10 a.m., two (male and female) were flushed about 30 feet apart, each from the shade of a small arrowweed clump. They showed no interest in the locality, but flew straight away northwards, mounting higher and higher into the shimmering sky, probably in migration.

Five specimens taken: No. 27916, ♂, April 19, 1917; no. 27917, ♂, April 20, 1917; no. 40534, ♂, April 6, 1920; no. 40677, ♀, April 12, 1920; no. 40535, ♂, April 15, 1920. The weights of the four males were, respectively, 45.5, 53.1, 59.2 and 61.4 grams; all were more or less fat. None of the nighthawks taken showed any signs of immediate breeding.

45. **Chaetura vauxi** (Townsend). Vaux Swift.

Mr. Dixon examined a bird of this species which was shot May 22, 1917, by his assistant at Salt Creek, —200 feet. The day was intensely hot there, and the specimen was not preserved.

46. **Aëronautes melanoleucus** (Baird).

White-throated Swift.

Visited Furnace Creek Ranch at irregular intervals, mostly on calm warm days. Specimens taken showed breeding activity, so that the birds doubtless had their headquarters in some precipitous place in the mountains closely adjacent to Death Valley. Noted first on April 2, 1917. The greatest number checked on one day was on April 29, 1917, when sixteen were counted in one dizzying troupe high overhead above the alfalfa fields. The least number for one day was two on April 16, 1920.

Three specimens taken: No. 27923, ♀, April 3, 1917, weight 34.5 grams; no. 27924, ♂, April 29, 1917, weight 31.3 grams; no. 40537, ♂, April 19, 1920, weight 28.3 grams.

In 1891, found at Mesquite Wells April 8, and at Furnace Creek Ranch April 15 and June 20 (Fisher 1893, pp. 55, 151).

47 **Archilochus alexandri** (Bourcier & Mulsant).

Black-chinned Hummingbird.

One specimen shot from cottonwood at Furnace Creek Ranch, April 22, 1917; no. 27926, ♂ adult; weight 2.9 grams.

48. **Calypte costæ** (Bourcier). Costa Hummingbird.

At Triangle Spring, —13 feet, April 17, 1917, one lone female was found before sunrise perched near the ground in the center of a mesquite thicket; and at noon of the same day a male inspected a red "carnation milk" can in camp. At Furnace Creek Ranch at least five of these hummingbirds were seen on April 22, 1917, and one was seen the next day. All were in the fields of blossoming alfalfa.

Two specimens taken: No. 27932, ♀, Triangle Spring, April 17, 1917, weight 3.0 grams; no. 27933, ♀, Furnace Creek Ranch, April 22, 1917, weight 2.8 grams. Neither showed signs of immediate breeding.

In 1891, found at Furnace Creek Ranch April 12 and June 19 (Fisher, 1893, pp. 57, 151).

49. **Selasphorus rufus** (Gmelin). Rufous Hummingbird.

A male heard and seen by me near Furnace Creek Ranch on the morning of April 29, 1917, as it skimmed along a line of mesquites.

50. **Tyrannus verticalis** Say. Western Kingbird.

A fairly common migrant during April in the vicinity of Furnace Creek Ranch. In 1917, noted from April 6 to April 28; in 1920, from April 7 to 20. Usually but one to three seen in a two- or three-hour census. On April 28, 1917, seven were counted in one "drove". On the evening of April 22, 1917, after sundown, eight appeared, descending from high in the sky, and alighted in two dead-topped cottonwoods on the ranch. On April 10, 1920, one flew over, going north, near the Borax Mill, two miles or so north of the ranch.

Three specimens taken: No. 27942, ♂, April 22, 1917, weight 44.5 grams; no. 27943, ♂, same date, weight 39.0 grams; no. 40538, ♂, April 7, 1920, weight 43.3 grams.

51. **Myiarchus cinerascens cinerascens** (Lawrence).

Ash-throated Flycatcher.

Noted by me only at Furnace Creek Ranch, in 1917. Observed on April 26, 29 and 30, one bird each day. A male, no. 27949, shot on the last specified date; weight 27 grams.

In 1891, a pair was seen at the mouth of the cañon just above Furnace Creek Ranch, June 21, and the species was thought to be breeding at the bottom of Mesquite Valley [Flat] (Fisher, 1893, pp. 60, 61, 151).

52. **Sayornis sayus** (Bonaparte). Say Phœbe.

Permanently resident and widely distributed in Death Valley. Probably able to go entirely without water, even in the hottest weather, save for such as may be secured along with its insect food or elaborated during the processes of metabolism.

In the near neighborhood of Furnace Creek Ranch during April, from one to three would be checked in a 3-hour census. At the Borax Mill, —200 feet, two miles or so north of the ranch a pair observed on April 10, 1920, were behaving as though a nesting site had been selected somewhere about the ruins. The next day one was heard singing among the crags of a "painted cañon" three or four miles south of the ranch.

Around Triangle Spring, —13 feet, April 15 to 17, 1917, up to four were seen daily. They were then in pairs and were prone to perch on the bare pebbly ground at the edge of the low bluff there; individuals were to be seen "prospecting" along the steep walls of the gullies which cut the mesa back of the bluff.

The Say Phœbe was one of the very few birds encountered in the lowest portion of Death Valley, at the east edge of "bad water" (of the U.S.G.S. map) April 21 and 22, 1920. On the 22nd, beginning at early dawn, about 4:15 a.m., two individuals sang continually with hardly a minute's cessation till 5:00 (that is, until broad daylight). As the snowy tops of the Panamints suddenly began to pink, throwing the light back against the dark-shadowed west wall of the Black Mountains, the Phœbes stopped singing. It had then become light enough for them to begin the morning's foraging.

Four specimens procured: Nos. 27952, ♂, 27953, ♂, 27954, ♀, 40540, ♂, April 9, 16 and 17, 1917, and April 19, 1920; weights, 20.6, 21.2, 16.9 and 22.5 grams.

In 1891, found at Bennett Wells and Furnace Creek Ranch the latter part of January, and at the latter place April 9, 12 and June 19-22 (Fisher, 1893, pp. 61, 62, 151).

53. **Sayornis nigricans** (Swainson). Black Phœbe.

Sparingly transient. Noted on or near Furnace Creek Ranch April 9, 10, 15 and 19, 1917, and April 8 and 9, 1920. Only one bird seen on any one day. One of the birds (April 8) was observed to start off in flight over the desert northward. One specimen taken, no. 27959, ♂, April 9, 1917; weight 17.7 grams.

Mr. Dixon saw one individual at Salt Creek, —200 feet, April 14, 1917.

In 1891, observed at Furnace Creek Ranch April 12 (Fisher, 1893, pp. 63, 151).

54. **Myiochanes richardsonii richardsonii** (Swainson). Western Wood Pewee.

Late migrant. Mr. Dixon noted "three or four" on Furnace Creek Ranch May 19, 1917.

55. **Empidonax hammondii** (Xantus). Hammond Flycatcher.

But one positively established occurrence: No. 27974, ♂, shot by me among the mesquites just west of Furnace Creek Ranch, April 11, 1917; weight, 9.5 grams; unequivocally *hammondii*. Another small flycatcher thought to be of the same species was seen at the same time and place.

56. **Empidonax wrightii** Baird. Wright Flycatcher.

One specimen shot by me in the mesquites below (west of) Furnace Creek Ranch, April 26, 1917: No. 27977, ♂; weight 12.0 grams; unquestionably *wrightii*.

57. **Empidonax griseus** Brewster. Gray Flycatcher.

Encountered in the mesquites just west of Furnace Creek Ranch on three different days: April 26, 1917, two; May 4, 1917, one; April 16, 1920, two. One obtained on each of these dates: No. 27978, ♂, weight 14.8 grams; no. 27979, ♂, weight 12.3 grams; no. 40544, ♂, weight 13.1 grams. All of these specimens show the characters of *griseus* in high degree.

In 1891, "a specimen [recorded as *wrightii*] was secured among the willows at the edge of the reservoir" at Furnace Creek Ranch, February 1, and "two small flycatchers, probably this species, were seen there about the middle of April" (Fisher, 1893, pp. 65, 66, 151). The specimen taken is a female, no. 140152, Biol. Surv. coll., U. S. Nat. Mus.; it is *griseus* without question.

58. **Pyrocephalus rubinus mexicanus** Sclater.

Vermilion Flycatcher.

Not found previously to 1920. On the morning of April 4 of that year a brilliant male was seen on a fence bordering an alfalfa field at Furnace Creek Ranch. It was shy, and flew from perch to perch until it launched out eastwardly high into the sky. On April 5, before sunrise, a male, not in fullest red plumage, was shot from one of the guy-wires of the hay derrick. And on April 8, a female was shot from the tip of a mesquite just outside the outer ranch fence. No one of these individuals showed any signs of immediate breeding.

On April 9, 1920, a brilliant male appeared along the main line of cottonwoods on the ranch perching on dead outswaying tips of the trees and upon fence-posts. It sang rather persistently a weak song of rising and falling inflection, reminding me much of a Traill Flycatcher. This was quite surely a new individual for the ranch, as it is hardly possible that so conspicuous a bird could have escaped my eye or ear on previous days. This same bird, I was positive, was observed almost daily until the 16th; and on the 14th it was noted in close attention upon a new female in a dead-topped cottonwood right above camp; thereafter both were seen at frequent intervals, sometimes along the line of cottonwoods, often on fence-posts, and occasionally around the big pile of weevily mesquite logs. On the 15th the pair was apparently prospecting for a nest site in a dead cottonwood; the male would fly out and up, circling slowly on fluttering wings, the female giving a low note, *pseet,* in series meanwhile; then the male would sing his sputtering song, weak but reminding me of a Black Phœbe or a Traill Flycatcher.

Nothing was seen of the species after April 16. I had refrained from disturbing the pair in any way, and they were too wary for the Indian children to get with bow and arrow as they did the robins. It is my impression that all the birds seen are best considered as winter or early spring wanderers northwestward from their known breeding grounds. They are thus to be placed in the same category with the occurrences of this species on the coastal slope of southern California. This Death Valley record now made is about 100 miles to the northward of the previous northernmost station of occurrence in California, which is on the Colorado River near Needles.

The two specimens, taken April 5 and 8, are: No. 40546, ♂, weight 13.3 grams; no. 40547, ♀, weight 12.9 grams.

59. **Otocoris alpestris ammophila** Oberholser.

Mohave Horned Lark.

Two Horned Larks were noted at Furnace Creek Ranch, April 12, 1917. One individual was heard and seen in flight April 11, 1920, at the tip of "black point", near B.M. —223, six miles south of the ranch. These are referred with confidence to *ammophila* because this was the race to which a number of specimens belong, which were secured in the general region of Death Valley.

60. **Pica pica hudsonia** (Sabine). Black-billed Magpie.

Mr. and Mrs. Dane Coolidge saw four magpies one-half mile east of Furnace Creek Ranch on December 26, 1919; and two more were seen at the ranch December 29. A magpie was caught by an Indian boy in a steel trap set beside a dead horse near the ranch, and parts of the bird were saved by Mr. and Mrs. Coolidge and brought to the museum (constituting no.

40425). Mr. Denton reported that about October 25, 1919, great flocks of magpies, numbering probably 1500 in all, came from the north and swarmed all over the fields. They gradually drifted away, and the ones seen by Mr. and Mrs. Coolidge, as above, were the last of the invasion. Mr. Denton had never seen this bird in Death Valley before, and two old Indians made the same declaration, though a boy claimed he had seen lots of them.

This record is the southernmost to date for the species in California, and indicates a sporadic southward drift of population, probably merely local, from northern Nevada perhaps.

61. **Corvus corax sinuatus** Wagler. Western Raven.

Of regular and wide occurrence in Death Valley. Noted at Triangle Spring, —13 feet, April 15 to 17, 1917, one or two at a time. On the 16th, two were seen at sunrise perched on a bare mound out on the plain; and later the same day a pair circled over camp, quarreling over something which one of the birds had in its bill and kept hold of despite the repeated attacks of the other bird.

Ravens were seen at Salt Creek, —200 feet, every time the place was visited. On April 3, 1920, five flew by in one party. In 1917 a pair had its nest on a ledge near the top of the face of a low bluff half a mile or so below the road crossing. On May 21 this nest was found to contain young nearly ready to fly; one was taken and its stomach examined; contents: "tails and feet of two lizards, about a dozen small fish from Salt Creek and several large white worms" (Dixon, MS). The fishes in Salt Creek, as identified from specimens submitted by me to Dr. Chas. H. Gilbert of Stanford University, are *Cyprinodon macularius.*

At Furnace Creek Ranch, ravens were to be seen almost daily, usually but one or two each day. On April 21, 1920, one was seen eating caterpillars on an alfalfa stubble field. On the preceding day a company of eight came flying over the ranch against a strong south wind. By giving the "bluejay call" these were gotten to circle low over the collector concealed in some brush and one was shot: No. 40551, ♂ a year old, nonbreeder; weight, 785.5 grams.

Near B.M. —223, not far from "black point", some six miles south of the ranch, a raven was seen April 11, 1920, flying above the "borax" flat. And near "bad water", —280 feet, two flew by low over the flat at 5:30 p.m., April 21, 1920.

In 1891, "in Death Valley they were observed by every party that visited the place from the first week in January to the last in June" (Fisher, 1893, pp. 71, 151).

62. **Corvus brachyrhynchos hesperis** Ridgway.

Western Crow.

Noted but twice at Furnace Creek Ranch: April 6, 1920, one lone bird flying low over the desert in direct course northward, cawing occasionally; April 21, 1920, one on alfalfa stubble apparently eating caterpillars; kept in vicinity of a raven, flying up to a fence-post now and then, and did a great deal of cawing although otherwise alone.

63. **Molothrus ater obscurus** (Gmelin). Dwarf Cowbird.

Appeared in some numbers (up to six in sight at once) on Furnace Creek Ranch the third week of April. Frequented the stock corrals and the cottonwood trees adjacent, often in company with Brewer Blackbirds. Specimens obtained as follows:

No.	Sex	Date	Weight	Wing
28095	♀	April 24, 1917	30.0 g.	92.1 mm.
28097	♀	April 27, 1917	30.7	91.9
28098	♀	May 4, 1917	31.5	91.6
28096	♂	April 24, 1917	36.3	101.0
40553	♂	April 20, 1920	38.6	104.9

Weights seem to be diagnostic, as well as wing-lengths (see Grinnell, 1914, pp. 159-160); no. 40553 is rather large for *obscurus,* perhaps an intergrade towards *artemisiæ.*

64. **Molothrus ater artemisiæ** Grinnell. Nevada Cowbird.

Two specimens secured at Furnace Creek Ranch: No. 28100, ♀, April 27, 1917; weight 36.3 grams; wing 105.1 mm. No. 40552, ♂, April 20, 1920; weight 47.5 grams; wing 109.2

mm. Each of these was taken when cowbirds of the other subspecies were present also.

A cowbird shot at Salt Creek, —200 feet, May 22, 1917, but not preserved, was thought to have been of this race.

In 1891, a lone bird, an adult male, was secured at Furnace Creek Ranch, June 20 (Fisher, 1893, pp. 73, 151). This example is now no. 142103, Biol. Surv. coll., U. S. Nat. Mus.; ♂; wing 112.8 mm.; culmen 17.6; it has been examined by me and proves to be *artemisiæ* without a question.

65. **Xanthocephalus xanthocephalus** (Bonaparte).

Yellow-headed Blackbird.

Present on Furnace Creek Ranch off and on almost throughout the month of April. Noted in 1917 from April 4 to April 29; in 1920 from April 4 to 20. Usually seen in company with Red-winged Blackbirds, but sometimes flocked separately; occasionally but one or two would be seen in with a crowd of red-wings, and then again up to 15 would be counted. Old males were present up to the latest date when the species was observed at all, but no indications of immediate breeding were noted. It was inferred that all of the birds were still in transit. There was no doubt but that the population on the ranch was continually shifting. Some days a thorough census would show not a bird present; then a flock would suddenly appear and forage eagerly around the corrals or on the fields. The gullet of a male killed on a newly sown field April 8, 1920, was full of wheat. Seen away from the immediate environs of the ranch but once, on May 20, 1920, when three were encountered in some mesquites along an overflow streamlet down at the edge of the "borax" flat, —250 feet, west of the ranch.

Specimens were preserved as follows:

No.	Sex	Date	Weight
28113	♂ ad.	April 4, 1917	95.5 grams
28114	♀ ad.	April 24, 1917	63.7 grams
28115	♂ ad.	April 26, 1917	95.0 grams
40558	♂ ad.	April 8, 1920	102.8 grams

In 1891, a specimen was secured at Bennett Wells, April 1 (Fisher, 1893, pp. 73, 151); now no. 139434, Biol. Surv. coll., U. S. Nat. Mus.; ♂ adult.

66. **Agelaius phœniceus nevadensis** Grinnell.

Nevada Red-winged Blackbird.

Present almost every day through April of both 1917 and 1920, but varying in numbers. No doubt frequent replacements occurred; in other words the species was actively transient. However, no fully adult males proved to be included among the specimens taken, nor were such seen positively. It was inferred that all or most of the old males had already passed through or else that they did not tarry.

The Red-winged Blackbirds which loitered at Furnace Creek Ranch found favorable perching places there in the cottonwoods and forage ground out in the fields, either of grain or alfalfa. Some days only two, or even none, would be checked in a census of the ranch. On April 19, 1917, fully seventy-five were present, and on April 26 of the same year, late in the evening, a flock of approximately one hundred arrived and alighted out in an alfalfa field of several acres, apparently to roost there.

Eighteen specimens were taken, nos. 28117-28, 40560-65. All the seven males included have imperfect shoulder-bars and thickish bills, these being marks of immaturity. The females, however, seemed to be mostly adults; none showed signs of immediate breeding. All of the specimens taken are referable to the race *nevadensis*. The weights of the seven males vary from 55.0-64.5 grams (average 60.5), of the eleven females, 41.0-49.6 grams (average 45.2).

At Triangle Spring, —13 feet, April 15, 1917, two Red-winged Blackbirds flew by going north; and at Salt Creek, —200 feet, April 3, 1920, four were seen about a marshy place.

In 1891, eight or ten individuals comprising a flock were seen at Furnace Creek Ranch during the latter part of January (Fisher, 1893, pp. 74, 151).

67. **Sturnella neglecta** Audubon. Western Meadowlark.

Permanent resident on Furnace Creek Ranch. In April, 1920, there were thought to be seven pairs established for nesting, the males sequestered and singing. In addition, companies of six to twelve were seen from time to time, which would subsequently disappear and were supposed to be winter visitants or transients. Even as late as April 29, 1917, eight silent individuals were seen in a scattering flock, transients it was thought. The Indian children told me that they often found meadowlarks' nests "in the summertime". This means June, and in substantiation of this lateness of nesting, no evidences of actual eggs or young were noted by us up to the first of May. One bird was seen carrying grass in its bill on April 29.

This lateness of the nesting of Meadowlarks in Death Valley is hard to reconcile with the theory that it is the accumulation of heat to a certain critical quantity with the approach of spring which initiates the reproductive cycle. For it is certainly far hotter at Furnace Creek Ranch in April than it is in west-central California in July even, where the Meadowlarks are nesting generally by the first of April.

The songs of the Death Valley Meadowlarks as a lot sounded different, less full and rounded, to my ear than the usual ones heard in California west of the deserts. Yet there was also much individual variability. I got to know by its song each of the males located in the fields on the eastern part of the ranch near our camp. One particular bird had a curiously "flatted" song which was repeated with great persistence most of the day so that it would become distressingly monotonous.

Two specimens taken: No. 28159, ♂, April 12, 1917, weight 119.3 grams; no. 40566, ♂, April 15, 1920, weight 106.2 grams. These do not differ appreciably from skins of the same season taken at various points on the Pacific slope of California.

Mr. Dane Coolidge found fifteen or twenty Meadowlarks present on the plowed fields of Furnace Creek Ranch in December, 1919.

In 1891, they were "not uncommon" at Bennett Wells, near Eagle Borax Works, and at Furnace Creek Ranch; present at the latter point the last of January and June 19-21 (Fisher, 1893, pp. 75, 76, 151). Three specimens are in the Biological Survey collection, U. S. National Museum, all taken in 1891 at "Furnace Creek" Ranch, as follows: No. 139406, ♂, January 28, 1891, A. K. Fisher; no. 139407, ♀, January 23, 1891, A. K. Fisher; no. 139396, ♂, June 19, 1891, V. Bailey. The bill of the last is longest and is blackish as is the case with some breeding males of the species; and of course the plumage of the bird is much worn.

68. **Icterus cucullatus nelsoni** Ridgway.

Arizona Hooded Oriole.

One occurrence: A lone individual was caught sight of twenty feet above the ground in the crown-foliage of a cottonwood on Furnace Creek Ranch, April 8, 1920. The bird, when I shot it, proved to be an "immature" male (throat black, but no black elsewhere in the plumage): No. 40567; weight 25.2 grams. This bird furnishes the northernmost record for California east of the Sierran divides by fully 250 miles—a far-flung pioneer.

69. **Icterus bullockii** (Swainson). Bullock Oriole.

Nesting in the cottonwood trees on Furnace Creek Ranch. First arrival noted in 1917 at 6:30 a.m. of April 10, in 1920 on the morning of April 12, solitary males in both cases. Males were seen daily after these initial dates, but no female was seen in 1917 until April 20 and in 1920 until April 14. The males, before the arrival of the females, did a great deal of singing, and just as soon as they arrived each laid claim to a particular row of trees, from which it expelled other individuals of the same species. In 1917 there were thought to be six males established on the ranch (by the 23rd of April); in 1920 there were only two males established, though as many as four others, thought to be transients, were noted in one day (on April 19).

On April 29, 1917, a nest had been well started in an out-swaying leafy branch of a cottonwood, but a gale thrashed it to pieces. Most of the nests built on Furnace Creek Ranch must meet a like fate. Yet there were old nests, of a previous season, still holding out in some of the cottonwoods, and it is to be inferred that some of the nestings are successful.

Three specimens taken: No. 28166, ♂, April 22, 1917, weight 32.5 grams; no. 28167, ♂, April 22, 1917, 31.4 grams; no. 40568, ♂, April 21, 1920, 35.5 grams.

In 1891, the species was noted only casually, one bird being recorded as observed among the cottonwoods at Furnace Creek

Ranch "about the middle of April". A specimen is listed as taken in "Death Valley", April 7 (Fisher, 1893, pp. 77, 78, 151). This proves to be no. 139368, ♂, Biol. Surv. coll., U. S. Nat. Mus.; April 7, 1891, V. Bailey; "Bennett's Wells".

70. **Euphagus cyanocephalus cyanocephalus** (Wagler).

Rocky Mountain Brewer Blackbird.

Present off and on nearly through April. Last seen on April 29, in 1917. Usually from three to ten would be noted in a three-hour census. But on April 24, 1917, at sundown, a flock about fifty put in an appearance in the enclosure around the main haystack; and a little later the same evening a flock, or *cloud*, of fully two hundred blackbirds (some, at least, of which were Brewers) appeared high overhead, but drifted off northward without settling.

Ten specimens taken: Nos. 28172-79, 40569-70, of dates ranging from April 11 to April 24. Weights: 3 ♀♀, 54.4-65.2 grams (average 61.2); 6♂♂, 71.0-85.7 grams (77.4). (For critical discussion of the race to which these specimens belong, see Grinnell, 1920, p. 153.)

At Salt Creek, —200 feet, April 14, 1917, one lone male Brewer Blackbird came sociably around camp, "talked" a good deal, and seemed glad to find company even though human. The chance of finding a bit to eat doubtless also figured in the bird's attitude.

In 1891, "a few individuals were found about the ranch at Furnace Creek . . . in the latter part of January" (Fisher, 1893, pp. 78, 79, 151). Two taken: No. (Biol. Surv. coll., U. S. Nat. Mus.) 139311, ♀, January 27, 1891; and no. 139310, ♀, January 25, 1891.

71. **Carpodacus purpureus californicus** Baird.

California Purple Finch.

A casual visitant. On the forenoon of April 11, 1917, I flushed two from the ground in the edge of an alfalfa field on Furnace Creek Ranch. They flew up into a cottonwood, where one was shot: No. 28187, ♀ (no sign of early breeding); weight 21.8 grams.

72. **Carpodacus mexicanus frontalis** (Say).

California Linnet.

A permanent resident in Death Valley. Of frequent but not continuous occurrence on Furnace Creek Ranch. While seen on or near the ranch in April, on a good many days from the 4th to the 29th inclusive, no indication of nesting there was noted. Usually from two to ten individuals would be checked in a two- or three-hour census. On April 20, 1920, between the ranch and the "borax" flat to the west, thirteen Linnets were checked in three hours; these were mostly in flight high overhead, some of them in a course directly across the Valley from the direction of the Panamint Mountains.

On April 11, 1920, several Linnets were met with at about sea-level in a narrow "cork-screw" cañon in the Black Mountains six miles or so south of Furnace Creek Ranch. A female was seen to fly from a little hole in the rock wall about fifteen feet above the bed of the gulch, where I supposed she had a nest. Males were heard singing from high among the varicolored crags.

Linnets were frequent visitants to Triangle Spring, —13 feet, April 15 to 17, 1917; up to ten were checked as a result of two hours of watching. Several of the birds were seen on the nearby mesa feeding on the seeds of the desert holly *(Atriplex hymenelytra)*. At Salt Creek, —200 feet, fully fifteen were noted on April 14, 1917, nearly all in flight overhead whence their cheerful-sounding songs would indicate their presence and direction of flight, even though the birds themselves could not be descried against the shimmering blue of the desert sky. None was seen to visit the salty water.

There is no question but that Linnets must have fresh water to drink daily and probably two or more times a day. Yet the presence of the birds in a particular place does not necessarily mean the existence of water anywhere in the vicinity; for they certainly fly far and wide, many miles away from their headquarters, in search of desirable forage.

Seven specimens were preserved from Death Valley, nos. 28192-97, 40571; the two females weighed 18.2 and 18.7 grams, and the five males 17.5-20.7 grams (average 19.5).

In 1891, "a few [Linnets] were seen at Bennett Wells and between that place and Furnace Creek during the latter part of January". It was seen at Furnace Creek Ranch about the middle of April, and at this place and Bennett Wells June 19-22 (Fisher, 1893, pp. 80, 81, 151). In the Biol. Surv. coll., U. S. Nat. Mus., is a full-grown ♀ juvenal, no. 139215, taken by A. K. Fisher at Furnace Creek Ranch, June 21, 1891.

73. **Astragalinus psaltria hesperophilus** Oberholser.

Green-backed Goldfinch.

Present on Furnace Creek Ranch almost every day in April, from the 4th (in 1920) to the 29th (in 1917). The numbers varied greatly, and it was believed that birds were continually coming and going; no signs of nesting in Death Valley proper were noted. Usually only one or two would be seen or heard in a two- or three-hour census on the ranch; on April 26, 1917, twelve were checked in one hour, and on April 5, 1920, thirteen were counted in one flock perched in a cottonwood. Mostly, the birds were detected when in flight, but some were met with in the edges of the alfalfa, feeding on the seeds of the sow-thistle.

At Triangle Spring, —13 feet, April 16, 1917, three Green-backed Goldfinches were seen in flight.

Five specimens were taken on Furnace Creek Ranch: Nos. 28239-42, 40572; the two females weighed 9.4 and 8.7 grams, the three males 8.4, 8.9 and 8.3 (average of the five, 8.7 grams). These skins are indistinguishable from specimens of corresponding season from the Pacific slope of California.

74. **Poœcetes gramineus confinis** Baird.

Western Vesper Sparrow.

Present on Furnace Creek Ranch intermittently during April. Earliest noted, April 4 (1920); latest, April 29 (1917). Usually, when seen at all, from two to six or eight would be checked in a two- or three-hour census. Frequented the drier parts of the ranch, especially an abandoned alfalfa field, not regularly irrigated and weedy. On April 24, 1917, fifteen, the most met with in any one day, were counted on one ten-acre tract of new-mown alfalfa.

At Triangle Spring, —13 feet, a Western Vesper Sparrow was caught in an oat-baited mouse trap April 18, 1917.

Eleven specimens were taken, of dates ranging from April 7 to April 29: Nos. 28262-71, 40573. Weights: 5 ♀♀, 20.0-22.9 grams (average 21.3); 6 ♂♂, 20.8-25.5 grams (average 23.1). These skins are all definitely *confinis*. None of them shows any sign of molt in progress; it is curious that there should be no pre-nuptial molt in the Vesper Sparrows when there is, so conspicuously, in the Savannah Sparrows.

75. **Passerculus sandwichensis alaudinus** Bonaparte.

Western Savannah Sparrow.

Savannah Sparrows in varying numbers were to be found when looked for on Furnace Creek Ranch almost throughout April. They frequented the lush alfalfa and the tracts of Bermuda grass along the ditches, flying thence, when disturbed, to fence wires or up into cottonwoods or willows. Of the twenty-four specimens collected, fifteen are referred to *alaudinus* and nine to *nevadensis*. Only two or three of the specimens gave trouble in determining them, in that their characters were rather intermediate. The very pale coloration of "good" *nevadensis* made it possible to recognize many individuals subspecifically at ordinary field range, before being shot, especially when silhouetted against a dark alfalfa background.

Usually from four to ten Savannah Sparrows would be checked in two or three hours. On April 24, 1917, there were fully thirty-five on one ten-acre patch of alfalfa stubble. The gasping, sizzling songs were heard on April 22 and subsequently, but no indications of imminent breeding were shown by any of the birds collected.

Savannah Sparrows were observed at Salt Creek, —200 feet, April 14, 1917, and April 3, 1920. As many as six were flushed from one patch of cane, and some were seen in the salt grass areas.

The specimens of *alaudinus* taken range in date from April 4 (1920) to April 28 (1917). Their numbers are: 24281, 24283-89, 40575-81. Their weights: 10 ♂♂, 14.7-20.0

grams (average 18.1); 5 ♀♀, 14.5-17.5 (16.2); average of all 15, 17.4 grams. Many of the skins show the partial prenuptial molt in progress.

Savannah Sparrows were found in 1891 "not uncommon" in the alfalfa fields at Furnace Creek Ranch in the latter part of January, and April 9-12, but were not seen there in June (Fisher, 1893, pp. 86, 151). In the Biol. Surv. coll., U. S. Nat. Mus., are three skins taken by Dr. A. K. Fisher in 1891 on Furnace Creek Ranch as follows: No. 138940, ♀, January 26; 138941, ♂, January 31; 138942, ♂, January 31. All three are *alaudinus,* strictly.

76. **Passerculus sandwichensis nevadensis** Grinnell.

Nevada Savannah Sparrow.

Nine specimens of Savannah Sparrow referable to this race were taken on Furnace Creek Ranch: Nos. 28280, 28282, 28292-94, 28296, 40582-84. The dates of these range from April 4 to April 26 (both extreme dates in 1917). Weights: 5 ♂♂, 16.0 to 18.1 grams (average 17.2); 4 ♀♀, 14.3-16.4 (15.3); average of all 9 specimens, 16.4 grams. The feature of relatively small size in *nevadensis* as compared with *alaudinus* is borne out by the weights here recorded.

77. **Chondestes grammacus strigatus** Swainson.

Western Lark Sparrow.

A transient on Furnace Creek Ranch. First noted in 1917, on April 13, one bird at noon singing in a cottonwood; first in 1920, on April 16, a pair, one singing. On April 29, 1917, fully twelve were noted in a four-hour exploration of the ranch and its immediate environs. On intervening dates, when observed at all, two to ten would be observed. Latest date of observance, May 4, 1917.

Specimens taken, four, all males: Nos. 28327-30; weights, 28.4 to 31.7 grams (average 30.5).

78. **Passer domesticus domesticus** (Linnæus).

English Sparrow.

The greatest surprise, ornithologically, which I experienced on first visiting Death Valley came with the discovery, on April 2, 1917, that a colony of English Sparrows was well established on Furnace Creek Ranch. They were subsequently found to number about fifty, and to have their main headquarters in the tops of the several tall Washington palms which overshadow the ranch house. A few had their nests, built in usual style, of dry grasses and chicken feathers, in the higher forks of cottonwood trees elsewhere on the ranch. No birds were seen off the ranch proper, save as two or more pairs would occasionally venture up along the line of large mesquites to the Indian "village" along the in-flow ditch within three hundred yards east of the ranch house.

As to date of appearance of the English Sparrows in Death Valley, Mr. Oscar Denton, foreman of the ranch, stated to me that he first saw them in 1914; and that he thought they came in about the time the Death Valley spur of the Tonopah and Tidewater Railroad was constructed to its present terminus. This is at Ryan, which is only seventeen miles, by a road over which more or less teaming has been done, from the ranch. The sparrows are quite likely to have availed themselves of the horse litter of the construction camps along the route indicated. At any rate, they are now present at both Ryan and Death Valley Junction, as well as at other stations along the Tonopah and Tidewater Railroad.

In December, 1919, Mr. Dane Coolidge found the sparrows in evidence about Furnace Creek Ranch and estimated that "twenty-five or thirty" were sleeping in the fan palms. In April, 1920, I thought there must be close to sixty present all told. I tried repeatedly to count them, but never got more than twenty-four actually checked in one consecutive search of two to three hours. As usual, they were expert at keeping out of sight and hearing, especially when they got the idea that they were being sought for. The masses of dead, down-turned palm leaves formed ideal concealment for both the nests and the birds themselves.

When Mr. Denton fed his chickens, up to twenty-five or so of the sparrows would fly down with the fowls. Then it was that I shot most of the specimens taken. Mr. Denton himself was accustomed to "shoot off the sparrows" every now and then because he lost so much of his chicken-feed to them. With all the killing done, however, I could perceive no reduction in their numbers up to the time I left the ranch, April 22, 1920.

One of the "adults" shot April 3, 1917, a male, had "windows" in its skull. This indicated, according to my experience, that it could not have been over six months old, and this would mean a date of hatching about the first of October—surely a late nesting date. A female shot on April 12 contained an egg nearly ready to lay. The first young-of-the-year, two bob-tailed birds, came down from the crown of one of the big palms on April 13 (1920). However, six adult females shot on April 5 all had the ova small and otherwise showed no signs of nesting, so that breeding could not as yet have become general throughout the colony.

A total of twenty-seven measurable study-skins of English Sparrow are now available from Death Valley, nos. 28246-51, 40586-606; the first series of number applies to six birds taken April 3 and 5, 1917, and the second series to twenty-one birds taken April 5 to 12, 1920. In all of these abrasion of the plumage is slight, so that the wing measurements are of definite value. Thirteen males give an average wing length of 75.7 mm. (extremes 71.5 and 78.7); culmen, 12.1 (11.0-13.3). Fourteen females, wing 74.1 (71.0-78.0); culmen, 12.0 (10.7-12.9). Weights, thirteen males, 28.9 grams (26.9-30.6); fourteen females, 28.9 (24.0-31.0).

Witherby (Practical Handbook of British Birds, 1919, p. 101) says: "The wings of ninety British males measure 72-81 mm., average 76.2, and of 50 Continental males 75-82, average 78.9. The Continental House-Sparrow thus averages larger than the British, but of the ninety British measured by us only seventeen, or about nineteen per cent., could be distinguished by their size." He, therefore, does not consider a British race, *hostilis* of Kleinschmidt, as properly recognizable in nomenclature.

Whether or not a slightly smaller British race of *Passer domesticus* be recognized by name, it will be observed that the

Death Valley birds give a wing length practically the same as that of Witherby's British birds. And, of course, it will be recalled here that all American birds are quite surely derived from English stock.

As set forth elsewhere (Grinnell, 1919) the Death Valley colony furnishes an extremely interesting "experiment in nature". If it persists many years, opportunity will be afforded of seeing how soon, if at all, the extreme climatic conditions of the environment there will impress the birds with discernible features, such as paler coloration and reduced dark markings. The series of adult specimens thus far taken on Furnace Creek Ranch shows no appreciable peculiarities of either color or proportions as compared with others taken in west-central California and in the eastern United States. From most of these, it is true, the Death Valley birds stand out rather sharply by reason of their clean un-smoked plumage; they lack the dinginess of the usual town birds. But with all adventitious factors accounted for, I am unable to find any appreciable differences in either color tone, or extent of markings, of the sort usually characterizing deserticoline subspecies of birds.

However, the one juvenal taken on Furnace Creek Ranch (no. 40607, ♀, April 13, 1920, weight 18.2 grams) *is* distinctly paler, more ashy, less brown, in tone of color all over, than any comparable juvenals (six of them at hand) from the San Francisco Bay region. This is possibly significant of a tendency, first manifest in the young, towards paling of color in the Death Valley stock; but of course this material is altogether too scanty to warrant anything more than the merest suggestion.

It is to be hoped that collecting of English Sparrows in Death Valley will be possible from time to time, whereby judiciously small selections from the population there can be compared with series of the birds from elsewhere in North America.

79. **Zonotrichia leucophrys gambelii** (Nuttall).

Intermediate White-crowned Sparrow.

Present in small numbers in the vicinity of Furnace Creek Ranch. Noted in 1917 from April 3 to April 29, and in 1920 from April 7 to April 21. Usually but two to six would be checked in a two- or three-hour census. The greatest number encountered in one day was on April 16, 1920, when ten were checked in three hours. Found usually in the mesquite and arrowweed thickets just west of the ranch, where often commingled with groups of Brewer Sparrows. Several taken in mouse traps baited with rolled oats.

Seven specimens preserved, nos. 28338-41, 40608-09, 40678. Three males weighed 28.3-29.0 grams (average 28.7); four females, 21.1-24.8 (23.1). All showed molt in various stages, the dates ranging from April 3 to 22.

At Salt Creek, —200 feet, about ten were found in mesquites, April 14, 1917.

In 1891, found to be "common" about Furnace Creek Ranch the last of January and April 9-12 (Fisher, 1893, pp. 88, 89, 151). In the Biol. Surv. coll., U. S. Nat. Mus., are three skins, nos. 138816-18, ♂ and ♀ adult and ♂ in first-winter plumage, taken there by A. K. Fisher January 23 and 27, 1891.

80. **Spizella passerina arizonæ** Coues.

Western Chipping Sparrow.

Found sparingly on and around Furnace Creek Ranch, usually along the cottonwood rows or else in mesquites near the overflow ditches. Detailed records are as follows: In 1917, April 4, four; April 9, about eight; April 10, one; April 26, four. In 1920, April 7, one; April 11, two; April 15, about twelve in a 2½-hour census; April 16, four; April 19, two in a 3-hour census; April 20, about nine in a 3-hour census.

At Triangle Spring, —13 feet, two were seen April 17, 1917.

Four specimens preserved: Nos. 28347-48, 40611, 40679. Weights: 3 ♂ ♂, 12.5-13.2 grams (average 12.7); 1 ♀, 12.5 grams.

81. **Spizella breweri** Cassin. Brewer Sparrow.

The most plentiful sparrow in Death Valley, but doubtless occurring there only as a transient. Regularly present in the vicinity of Furnace Creek Ranch practically throughout April. First noted on April 3, 1917, when six were seen. Last noted on April 29, 1917, when they "were still swarming" in certain tracts of mesquites. Often as many as twenty-five would be checked in a 3-hour census; on April 16, 1920, 44 were checked in 3 hours; and on April 26, 1917, 110, approximately, were noted in 2 hours.

These sparrows showed a great weakness for bathing. They seemed to be spending most of the forenoon hours every day in the mesquites along the overflow ditches, thoroughly wetting the plumage in the shallow streamlets and then perching in the green-canopied branch-work above to preen at great length. Sometimes such bathing parties would be perfectly quiet save for the sound of fluttering wings. Then again some certain individual would break into prolonged singing, of a sort which reminded me of a Chipping Sparrow but which was more varied and with shrill intonations like a tame canary. Occasionally many, occupying adjacent mesquite thickets, would sing ecstatically in chorus, giving an effect of the bedlam of canary songs one hears in a bird store.

Three Brewer Sparrows were seen in some atriplex brush near B.M. —251, several miles north of Furnace Creek Ranch, April 13, 1917. At Salt Creek, —200 feet, about six were noted on April 14, 1917. And on April 15 and 16, the same year, fully twenty-five were checked on each day in the immediate vicinity of Triangle Spring, —13 feet.

Nine specimens were taken, at the last-named place April 15 and 16 (nos. 28353-56), and around Furnace Creek Ranch April 3 (1917) to April 20 (1920) (nos. 28352, 28357, 40612-14). The one female weighed 9.3 grams; seven males weighed 9.9 to 11.7 grams (average 10.8). Another male, very fat, weighed 14.9 grams.

In 1891 the Brewer Sparrow was found only in the northwest arm of Death Valley (Mesquite Flat) where one was shot April 13 (Fisher, 1893, pp. 91, 152).

82. **Junco hyemalis** (Linnæus). Slate-colored Junco.

On April 4, 1920, a lone Slate-colored Junco was seen foraging on some freshly-seeded ground in the shade of a cottonwood close to our camp on Furnace Creek Ranch. The bird was, by plumage, a male. It presently flew into a cottonwood, thence off eastward. The subspecies is, of course, in doubt.

83. **Junco oreganus shufeldti** Coale. Shufeldt Junco.

Observed twice, one lone bird each time (April 4 and 9, 1917), in mesquites near Furnace Creek Ranch; on the second occasion in company with some Chipping Sparrows. The one secured (no. 28368, on April 4) is a male; weight, 18.0 grams; wing, 78.0 mm.; tail, 66.4; tarsus, 21.2; culmen, 10.6; color of dorsum dull army brown. The determination of this example as *shufeldti* is concurred in by Mr. H. S. Swarth.

84. **Amphispiza bilineata deserticola** Ridgway.

Desert Black-throated Sparrow.

Observed twice in Death Valley. On April 7, 1920, two individuals were overtaken (one of them "collected") as they dodged from one desert holly bush to another on the wash fan, about —150 feet, two miles or so south of Furnace Creek Ranch; and on April 21, 1920, I shot a bird from the ground beneath a desert holly bush at about —280 feet, less than 50 yards from the very edge of the lowest part of the sink (the point called "bad water" on the U.S.G.S. map). This last was the lowest recorded occurrence of any bird in Death Valley.

Two specimens taken, as above: No. 40616, ♀, weight 13.3 grams; no. 40617, ♂, weight 13.7 grams.

85. **Amphispiza nevadensis nevadensis** (Ridgway).

Nevada Sage Sparrow.

Evidently a winter visitant. In 1891, "found in Death Valley from the lower end to Furnace Creek [Ranch], January 21 to February 4;" also seen near Bennett Wells, April 9-12, and in Mesquite Valley, April 13 (Fisher, 1893, pp. 97, 152). In the Biol. Surv. coll., U. S. Nat. Mus., there are two specimens taken by A. K. Fisher at Furnace Creek [Ranch] January 21 and 27, 1891: No. 136036, wing 77.2 mm., culmen 11.0; no. 136037, wing 73.6 mm., culmen 9.1 (measurements taken by the present writer). The sex is not recorded in either case; but it is evident that the first is a male, the second a female.

86. **Amphispiza nevadensis canescens** Grinnell.

California Sage Sparrow.

One specimen: No. 28405, ♂, taken by Mr. J. Dixon near Furnace Creek Ranch, April 3, 1917; weight 16.5 grams, wing 70.9 mm., culmen 9.8 mm. With sex considered, this is decidedly too small for *nevadensis;* hence *canescens.* The latter is apparently the breeding form on the Panamint Mountains closely adjacent to Death Valley.

87. **Melospiza melodia fallax** (Baird).

Rocky Mountain Song Sparrow.

Two examples secured by us, both at Furnace Creek Ranch, where they were living in arrowweed thickets along overflow ditches: No. 28426, ♀, April 6, 1917, weight 16.5 grams; no. 40619, ♀, April 6, 1920, weight ("fat") 22.2 grams.

I have compared these two, as also the 1891-taken skin referred to below, with the actual types of *M. m. fisherella, montana,* and *fallax* in the U.S. National Museum. As already set forth (Grinnell, 1909, p. 269) the older name *fallax* applies, not to the "Desert" Song Sparrow, but, at least in part, to what has been called *"montana"*. The type of *fallax* is in fresh plumage and the color differences shown by it as compared with *"montana"* are accounted for chiefly upon the basis of this circumstance. *Fisherella,* as far as I am able to see now, is not so very well characterized as differing from *fallax.* At any rate, all three of the Death Valley birds seem to me to belong to one form, which form should bear the name *fallax.* It is thus the Rocky Mountain race of Song Sparrow which winters in Death Valley. No race of Song Sparrow whatsoever is known to breed anywhere in the Death Valley region.

Song Sparrows were found "tolerably common" in 1891 at Furnace Creek Ranch, January 25 to February 3, but were not found there in June; recorded under the name *montana*

(Fisher, 1893, pp. 99, 152). One preserved: No. 138288, Biol. Surv. coll., U. S. Nat. Mus.; "Furnace Creek", Death Valley; January 25, 1891; A. K. Fisher.

88. **Melospiza melodia saltonis** Grinnell.

Salton Sink Song Sparrow.

One record: A male (no. 40620, weight 21.8 grams) shot by me on April 5, 1920, in arrowweed thicket at edge of artificial "overflow" pond just off the western edge of Furnace Creek Ranch. The skin is not distinguishable in any respect from specimens of *saltonis* from the lower Colorado River valley. Here is a striking case of an individual seeking out in a sequestered spot the precise association in which the species in its metropolis lives—in this case the arrowweed association (see Grinnell, 1914, p. 175). The bird was fat, with testes small, and was obviously a vagrant.

89. **Melospiza lincolnii lincolnii** (Audubon). Lincoln Sparrow.

Observed only at Furnace Creek Ranch, where a transient. Curiously, in 1917 detected but twice, April 10 and 11, one individual in each case; while in 1920 noted almost every day from April 4 to 21, inclusive. The largest number checked on any one day was six, on April 9; ordinarily from one to four would be met with. Found mostly in rank-growing vegetation along the irrigation ditches whence the birds would be flushed into view momentarily. Where arrowweed thickets were close by they would seek more adequate shelter in these. In only one case was an individual found away from the near vicinity of water: on April 11, 1917, one was caught in an oat-baited mouse trap beneath a mesquite fully 1½ miles north of the ranch.

Seven specimens taken, all referable to the subspecies *M. l. lincolnii:* No. 28427, ♀, and nos. 40621-25, 40680, all ♂♂; dates of capture ranging from April 4 to April 12; weights: of ♀, 14.5 grams, of six ♂♂, 16.0-18.8 grams (average 17.6 grams).

90. **Guiraca cærulea salicarius** Grinnell.

California Blue Grosbeak.

One shot from a fence post between two alfalfa fields on Furnace Creek Ranch April 28, 1917: No. 28505, ♂, adult, weight 26.2 grams. In size and proportions of bill this specimen is intermediate between *salicarius* and *lazula,* nearest the former.

In 1891, an adult male was secured at Furnace Creek Ranch, June 19 (Fisher, 1893, pp. 106, 107, 152). This specimen I find to bear further data as follows: No. 138105, Biol. Surv. coll., U. S. Nat. Mus.; ♂; V. Bailey. It is of an intermediate character, remarks applying as above.

91. **Zamelodia melanocephala** (Swainson).

Black-headed Grosbeak.

Mr. Dixon noted one bird on Furnace Creek Ranch, May 19, 1917; doubtless a transient. The subspecies is, of course, not known.

92. **Passerina amœna** (Say). Lazuli Bunting.

Only one record: in 1891, a specimen was secured "in the brush near the ranch [Furnace Creek], June 19" (Fisher, 1893, pp. 107, 108, 152). This specimen is a female, no. 142059, Biol. Surv. coll., U. S. Nat. Mus.

93. **Piranga ludoviciana** (Wilson). Western Tanager.

On April 25, 1917, about 8 a.m., I heard one individual in the cottonwoods above camp on Furnace Creek Ranch.

94. **Petrochelidon albifrons** (Rafinesque). Cliff Swallow.

A transient; observed only at Furnace Creek Ranch, where appeared from time to time in April, 1917, over the alfalfa fields. Details of occurrence were as follows: April 9, four seen at noon careening against the high wind; April 10, six noted; April 21, about eight; April 29, a troupe of about fifteen, sweeping back and forth over the alfalfa in the evening until so late that I could barely see them against the western sky, in company with bats.

Two specimens taken: Nos. 28527-28, both ♀♀, April 10 and 29, respectively; weight, 18.2 and 27.0 grams; wing, 105.9 and 108.5 mm. The latter is thus a decidedly bigger bird than the former, and may possibly have been bound for a more northern station for summering; but it is not as big as Oberholser's *hypopolia,* separated as a northwestern race of Cliff Swallow (Oberholser, 1919, p. 95). I have at present no good basis for selecting any subspecific name for these specimens. No evidence of the nesting of the Cliff Swallow anywhere in the Death Valley region was found by us.

95. **Hirundo rustica erythrogaster** Boddaert.

American Barn Swallow.

A transient which was observed only on or near Furnace Creek Ranch, as follows: In 1917, on April 2, two; on April 26, two tacking over alfalfa against northerly gale; April 28, two in flight against north wind, later alighting on stays of derrick. In 1920: April 20, one; April 11, about six; April 15, about four in morning and others in evening; April 16, two. Three taken: No. 28529, ♀, April 28, weight 18.6 grams; no. 40629, ♂, April 15, 17.8 grams; no. 40628, ♂, April 11, 20.0 grams.

96. **Iridoprocne bicolor** (Vieillot). Tree Swallow.

Observed as a transient at Furnace Creek Ranch as follows: In 1917 only on April 10, when two were seen; in 1920 on ten different days from April 4 to 20, two to six individuals per day. Seen usually over alfalfa with other swallows, more often in late afternoon, though not after sundown.

Three specimens taken: No. 28532, ♂, April 10, 1917, weight 15.6 grams; no. 40630, ♀, April 4, 1920, 17.4 grams; no. 40631, ♀, April 12, 1920, 15.4 grams.

In 1891 this swallow was "common" about the reservoir at Furnace Creek Ranch, March 23-24, and again the middle of April (Fisher, 1893, pp. 111, 152).

97. **Tachycineta thalassina lepida** Mearns.

Northern Violet-green Swallow.

Observed as a transient on or in the vicinity of Furnace Creek Ranch at rather frequent intervals through most of April in both 1917 and 1920. Earliest date, April 4, 1920, when four were seen; latest date, April 28, 1917, when two were seen. Usually but four to ten would be checked in a two- or three-hour census, but up to 18 (in two hours on April 23) were counted in a single day. Two specimens taken, nos. 40632-33, both males, on April 10, 1920; weights, 15.7 and 15.5 grams.

In 1891, many Violet-green Swallows were observed at Furnace Creek Ranch on April 10 (Fisher, 1893, pp. 111, 152).

98. **Stelgidopteryx serripennis** (Audubon).

Rough-winged Swallow.

This relatively xerophilous swallow had apparently arrived in the vicinity of Furnace Creek Ranch in both 1917 and 1920 before our advent in Death Valley. My first actual notebook entry is for April 4 in 1917, when a pair was coursing over the alfalfa, and April 6 in 1920, when one was seen. The last entry is for April 29 in 1917, when "six or more" were noted. But as indicated by the facts given below, the species probably stays all summer in the near environs of Death Valley and breeds. Usually from 4 to 6 would be checked during a two- or three-hour census; but on April 22 and 28, 1917, twelve were counted. These swallows evidently sometimes roosted at night on the stays of the hay derrick.

Five specimens taken, April 5 to 28, 1917: Nos. 28535-39; the one ♀ weighed 19.3 grams, the four ♂♂ 16.3 to 20.0 grams (average 18.3).

In 1891, several Rough-winged Swallows were recorded about the reservoir at Furnace Creek Ranch, June 19-21 (Fisher, 1893, pp. 112, 113, 152). I find the Biol. Surv. coll., U. S. Nat. Mus., to contain two skins, ♂ and ♀, both juvenals, full-grown, nos. 137930-31, taken by A. K. Fisher, June 19, 1891, at "Furnace Creek" [Ranch].

99. **Phainopepla nitens** (Swainson). Phainopepla.

Mr. Dixon secured an adult male (no. 28540) at Furnace Creek Ranch, May 19, 1917, the only example of the species noted by us or anyone else I know of in Death Valley proper.

The conspicuous scarcity of berry-eating birds such as the Phainopepla may be accounted for, in part at least, by the apparent complete absence of mistletoe on the mesquites of Death Valley. In Panamint Valley, only 25 miles to the westward, though 1200 feet higher, the mesquites were, in April, 1920, heavily laden with mistletoe, and this was fruiting abundantly. Phainopeplas and Waxwings were common there.

100. **Lanius ludovicianus excubitorides** Swainson.

White-rumped Shrike.

Present sparingly in Death Valley in winter, and in April up to the 20th of that month; but no data so far at hand indicate nesting in the below-sea-level area. The information secured by us is as follows:

Near B. M. —91, some two miles north of Salt Creek, a ♀ (no. 28543, not breeding, fat, weight 48.2 grams) was shot from the tip of an isolated arrowweed, April 18, 1917. The following three instances relate to the vicinity of Furnace Creek Ranch. April 20, 1917, no. 28544, ♂, weight 46.9 grams, was shot from a mesquite tip just north of the ranch; on April 5, 1920, no. 40638, ♂, testes small, weight 48.1 grams, was shot from the top of the farthest mesquite down towards the "borax" flat west of the ranch, about —250 feet; on April 7, 1920, no. 40639, ♂, testes small, fat, weight 51.9 grams, was shot from an outlying mesquite at the mouth of Furnace Creek wash, about —50 feet.

These four specimens represent one and possibly two of the minor geographic strains in the general geographic race currently called *excubitorides*. No. 28544 is darker backed than the others, with somewhat smaller and less strongly hooked bill, possibly in transit to some much more northern locality, and not representing the breeding form of the higher parts of the Inyo region. So far as observation went, each of the birds above recorded was alone.

Dane Coolidge saw a Shrike around the ranch in December, 1919.

In 1891, at Furnace Creek Ranch, "several [shrikes] were seen the last of January", and a specimen was taken February 3. It was also met with "in the clumps of mesquite, in Death Valley and Mesquite Valley, April 8-18" (Fisher, 1893, pp. 114, 115, 152). The specimen taken is a female, no. 137881, Biol. Surv. coll., U. S. Nat. Mus. It is like Mus. Vert. Zool. no. 28544, commented upon above.

101. **Vireosylva gilva swainsonii** (Baird).

Western Warbling Vireo.

Mr. Dixon heard the song of a Warbling Vireo on Furnace Creek Ranch, May 19, 1917.

102. **Lanivireo solitarius cassinii** (Xantus). Cassin Vireo.

One heard singing in a willow on Furnace Creek Ranch, April 23, 1917; secured: No. 28591, ♂, weight 16.1 grams.

103. **Vireo bellii pusillus** Coues. California Least Vireo.

Found by us in Death Valley but once, at Furnace Creek Ranch, April 10, 1920, when I heard a single one singing persistently from a line of mesquites down along an overflow ditch just west of the ranch. The bird was finally secured: No. 40641, ♂, very fat; testes not fully developed; weight 10.7 grams.

In 1891, a specimen was secured at Furnace Creek Ranch, June 20, and the species was considered "not uncommon" in the vicinity (Fisher, 1893, pp. 116, 117, 152). I have examined the following specimens contained in the Biol. Surv. coll., U. S. Nat. Mus.: No. 137718, ♂, "Furnace Creek", June 20, 1891; no. 137719, ♂, "Furnace Creek", June 21, 1891; both collected by A. K. Fisher, but last evidently taken up the creek "above the ranch", and hence probably above sea-level and out of the area covered by the present paper.

All three of the Least Vireos examined are referable to *pusillus* rather than to *arizonæ*.

104. **Dendroica æstiva rubiginosa** (Pallas).

Alaska Yellow Warbler.

On May 4, 1917, Mr. Dixon observed that Yellow Warblers were present on Furnace Creek Ranch in some numbers. "Half a dozen" at least were seen and one was taken: No. 28616, ♂, weight 10.0 grams. As is usually the case with the later migrants, a far northern subspecies was represented.

105. **Dendroica coronata hooveri** McGregor.

Alaska Myrtle Warbler.

At Furnace Creek Ranch, April 10, 1920, I shot a lone individual from the top of a new-leafed willow. I had already recognized it among the Audubon Warblers by reason of its coarser, less sharp call-note. The bird (no. 40642) was a male, in incomplete nuptial plumage, very fat, testes small; weight 14.7 grams; wing 75.2 mm.; white on three outer rectrices.

106. **Dendroica auduboni auduboni** (Townsend).

Audubon Warbler.

Winter visitant and transient in Death Valley, occurring rather widely. Its tastes are evidently broad, as compared with all other warblers at least; and, when need be, it can put up with conditions in almost any sort of association. At least four individuals were met with among the mesquites at Salt Creek, —200 feet, April 14, 1917. At Triangle Spring, —13 feet, on April 15, the same year, five were heard and seen in flight overhead; and, later, two appeared in some mesquites near the spring, but seemed not to be attracted by the water.

On and in the vicinity of Furnace Creek Ranch this warbler was in evidence almost every day that observations were made. The numbers varied greatly, from just one or two in a two-hour census to as many as 25, the latter number having been checked in three hours on April 16, 1920. The average number checked in 28 censuses was six. The earliest date included in the notebook records is April 4, 1917, one individual; the latest, April 29, 1917, about ten, two of them in song.

Most of the Audubon Warblers were seen in the cottonwoods and willows on the ranch proper. But numbers were met with in and about the tracts of mesquites, well apart from any influence of the ranch with its irrigating ditches. On certain days individuals would be heard (and then seen) in flight westward high overhead, going from the direction of the pass between the Black and Funeral ranges towards the northern end of the Panamint Mountains. Of course, to be within eye-sight of the ground, such birds were really only a few hundred feet aloft; but they likely represented only the lowest level of travelling multitudes.

Five specimens were taken: Nos. 28622-23, 40643-45, of dates April 6 to 24. Weights: one ♀, 12.0 grams; four ♂ ♂, 10.2-14.5 grams (average 12.8). All are in nearly or quite complete nuptial plumage. In characters throughout they are identical with the northwestern subspecies, *auduboni,* rather than approaching the Rocky Mountain subspecies.

In 1891, "a few [Audubon Warblers] were found among the willows bordering the reservoir" at Furnace Creek Ranch during the latter part of January, and again on April 10 (Fisher, 1893, pp. 119, 120, 152). The one specimen taken (male, no. 137410, Biol. Surv. coll., U. S. Nat. Mus., "Furnace Creek", February 1, 1891) has a long wing (80.7 mm.); but whether it is a big extreme of *auduboni,* or properly referable to *D. a. memorabilis* Oberholser, I am unable to say.

107. **Dendroica nigrescens** (Townsend).

Black-throated Gray Warbler.

Found twice, as a transient, at Furnace Creek Ranch: April 11, 1917, one in a cottonwood; April 14, 1920, one, singing persistently, in a mesquite. Both taken: the first, no. 28631, ♀, weight 9.5 grams; the second, no. 40646, ♂, weight 10.0 grams.

108. **Geothlypis trichas occidentalis** Brewster.

Western Yellow-throat.

Found by us only on Furnace Creek Ranch, where definitely noted as follows: April 26, 1917, three males in edge of rank alfalfa; April 10, 1920, two individuals in arrowweed thickets along overflow ditch; April 12 to 17, inclusive (1920), one or two birds each day in alfalfa or arrowweeds. One taken April 12, 1920: No. 40652, ♂; fat, weight 12.5 grams.

In 1891, "not uncommon" in Furnace Creek Cañon and at Bennett Wells, June 19-21; thought to be a "summer resident" (Fisher, 1893, pp. 123, 152). I have examined the specimen taken by A. K. Fisher June 21, 1891, at "Furnace Creek" (in this case probably the cañon above the ranch and not properly appertaining to Death Valley as now restricted). It is no. 137185, Biol. Surv. coll., U. S. Nat. Mus., ♂, and is in worn plumage as if it had bred in the locality. As far as the area below sea-level is concerned the species is probably only a transient.

109. **Icteria virens longicauda** Lawrence. Long-tailed Chat.

Mr. Dixon heard a Chat in a thicket near a duck pond at Furnace Creek Ranch repeatedly on May 4, 1917; this was our only meeting with the species.

In 1891, "chats were tolerably common" at Furnace Creek Ranch and "in the cañon above it, June 19-21"; thought to be a "summer resident" (Fisher, 1893, pp. 123, 124, 152). A specimen taken is no. 137159, Biol. Surv. coll., U. S. Nat. Mus., ♂, June 21, 1891; "Furnace Creek"; A. K. Fisher.

110. **Wilsonia pusilla pileolata** (Pallas).

Pileolated Warbler.

One individual observed closely by me, in mesquites just west of Furnace Creek Ranch, April 29, 1917.

111. **Anthus rubescens** (Tunstall). American Pipit.

Present on Furnace Creek Ranch during most of April of both 1917 and 1920. Usually found in scattering companies on newly sown or mown and freshly irrigated fields. On some days but two could be found; on other days up to 50 would be checked. And on the morning of April 29, 1917, one single flock of close to 100 was seen to descend in circling flight out of the sky as though just arriving after a prolonged flight. On April 18, 1920, about 50, closely massed, were seen to descend from high overhead about sundown and settle in a grain field.

Six specimens taken, nos. 28658-62, 40657. Weights of 2 ♂♂, 17.3 and 17.5 grams; of 4 ♀♀, 16.7 to 19.3 grams (average 18.2). One, a ♂, taken April 3, is in the midst of the prenuptial molt; in the rest, taken April 19 to 28, the molt into the cinnamon-breasted summer plumage is complete.

At Salt Creek, —200 feet, April 14, 1917, four or more Pipits were noted on damp portions of the alkali flats.

In 1891, "a flock of twenty or more was always to be found in the alfalfa fields" at Furnace Creek Ranch during the latter part of January (Fisher, 1893, pp. 125, 152). Two specimens are in Biol. Surv. coll., U. S. Nat. Mus.: Nos. 137004-05, both ♀♀ and taken by A. K. Fisher January 30, 1891. The plumage in both is extraordinarily worn and "alkalied".

112. **Oreoscoptes montanus** (Townsend). Sage Thrasher.

Noted but sparingly, as follows: Near Salt Creek, —200 feet, April 3, 1920, two were seen in an atriplex wash. On the desert in the vicinity of Furnace Creek Ranch, one was noted on April 3, 1917, one on April 8 of the same year, two on April 5, 1920, and seven on April 7, 1920. In the latter case the birds formed a scattering company which was moving along, chiefly on foot, over a gravelly washfan dotted with desert holly bushes.

Two specimens taken, April 3 and 8, 1917: Nos. 28668-69, both males; the first weighed 38.5 grams.

In 1891, "one was observed at Mesquite Well", January 20 (Fisher, 1893, pp. 126, 152).

113. **Mimus polyglottos leucopterus** (Vigors).

Western Mockingbird.

At Salt Creek, —200 feet, one was seen and pursued (without success) among mesquite bushes on April 14, 1917. Seen just west of Furnace Creek Ranch on April 4, 1917, and April 16, 1920, one in each case, likewise in mesquites. These three Death Valley individuals were astonishingly quiet and shy.

In 1891, Mockingbirds were seen in various parts of Death Valley proper and "in the northwest arm (Mesquite Valley), April 8-13, but were not seen anywhere in the valley during the trip of June 19-21" (Fisher, 1893, pp. 127, 152).

114. **Toxostoma lecontei lecontei** Lawrence.

Leconte Thrasher.

Seen in Death Valley only in the mesquite association where it was the "common" resident bird. Noted in the vicinity of Furnace Creek Ranch practically wherever there were mesquites, in some places down nearly to the very edge of the "borax" flat, —250 feet. This predilection for mesquites in Death Valley seems peculiar when it is recalled that on the Colorado Desert it is the Crissal Thrasher that is restricted to the mesquite association, while the Leconte Thrasher occurs exclusively elsewhere, on the more open desert. Perhaps for any sort of *Toxostoma,* the mesquites would be most preferred; the Crissal Thrasher is the species of pronounced adaptation to that association and occurs there to the exclusion of other species where there is more than one species in the general region; the Crissal is absent in Death Valley, and the Leconte has been able to take over the mesquite habitat because there is no rival thrasher there.

As to numbers, "common" is, again, a misleading term. The greatest number checked in any one day was five singing males, on April 7, 1920, in 4¼ hours on the desert within two miles south of Furnace Creek Ranch. Ordinarily but one to three birds would be seen in a day, no matter how many hours were spent tramping the sands.

Seven specimens taken, all adults, of dates April 7 to 29, inclusive: Nos. 28675-79, 40659-60. The one female weighed 64.3 grams; the six males, 58.5 to 64.3 grams (average 60.9).

In 1891, "a pair [of Leconte Thrashers] was seen at Bennett Wells January 21, others about the middle of April, and a pair with five young on June 21; at Furnace Creek [Ranch] one was seen the last of January;" also seen in Mesquite Valley (Fisher, 1893, pp. 128, 130, 152).

115. **Salpinctes obsoletus obsoletus** (Say). Rock Wren.

Observed by us within the below-sea-level parts of Death Valley, only south of Furnace Creek Ranch, along the base of the Black Mountains. On April 7, 1920, two pairs of Rock Wrens were found some 2½ miles south of the ranch, which seemed to have their interests centered in the broken walls of certain ravines; nesting was thought to be under way. On April 11, 1920, a lone individual was seen and heard near the end of "black point", a tract of black lava which juts out from the east into the "borax" flat near B. M. —223 of the map. And on April 21 and 22, the same year, a singing male was found to have its headquarters in the cliffs close to "bad water" of the map; he came down and "investigated" our camp, which was at the edge of the sink, probably about —250 feet.

One specimen taken: No. 40661, ♂, April 7; weight, 16.1 grams.

In 1891, the Rock Wren was seen only at Mesquite Well, January 20 (Fisher, 1893, pp. 132, 152).

116. **Thryomanes bewickii eremophilus** Oberholser.

Desert Bewick Wren.

In 1891, "a specimen was secured at Furnace Creek [Ranch], January 31, and a few individuals were seen among the mesquite thickets at Bennett Wells, and between that place and Saratoga Springs, about the same time"; recorded under the name *bairdi* (Fisher, 1893, pp. 134, 135, 152). I have examined the one specimen taken: No. 136664, ♂, "Furnace Creek", January 31, 1891, A. K. Fisher; it is *eremophilus,* as now understood.

117. **Troglodytes aëdon parkmanii** Audubon.

Western House Wren.

Observed only sparsely in April, on or near Furnace Creek Ranch. Stayed in rank alfalfa or thickets of arrowweed and mesquite along the ditches. The actual dates of record were: April 22, 23 and 24, 1917, and April 7, 9 and 13, 1920; but one bird on each occasion.

One specimen taken, no. 28709, ♀, April 22, 1917; weight 9.4 grams.

118. **Telmatodytes palustris plesius** (Oberholser).

Western Marsh Wren.

Noted at Salt Creek, —200 feet, April 14, 1917 (one individual in a patch of cane and one in pickle-weed); and on Furnace Creek Ranch April 8 and 16, 1920 (one individual each time, in rank grass or alfalfa near edge of irrigated field). Two shot: No. 28713, ♀, Salt Creek, April 14, 1917, weight 9.1 grams; no. 40664, ♂, Furnace Creek Ranch, April 16, 1920, weight 12.7 grams.

In 1891, "a few were seen at Furnace Creek [Ranch] and Bennett Wells" in January; recorded under name *paludicola* (Fisher, 1893, pp. 136, 152). One is preserved in Biol. Surv. coll., U. S. Nat. Mus.: No. 136778, ♂, Furnace Creek, January 31, 1891, A. K. Fisher; this is *plesius* beyond any doubt.

119. **Psaltriparus plumbeus** (Baird). Lead-colored Bush-tit.

Merely a vagrant on the floor of Death Valley. In the early morning of April 6, 1917, a troupe containing at least six individuals was seen moving north through the cottonwoods on Furnace Creek Ranch.

120. **Regulus calendula cineraceus** Grinnell.

Western Ruby-crowned Kinglet.

Observed only in the cottonwoods and willows on Furnace Creek Ranch, or else in the tracts of mesquite and arrowweed within a mile or so north and west of the ranch. Noted almost daily from the 5th to the 30th of April, inclusive, the years 1917 and 1920 both being taken into account. Never more than three individuals were seen in any one day; from one to three would be checked in the usual two- to three-hour census about the ranch.

Six specimens taken, nos. 28809-10, 40665-68, from April 6 to 20, inclusive, of the two years. The three males weigh 6.2, 7.1 and 6.9 grams; the three females, 5.8, 6.1 and 5.5

grams. All these skins show in normal degree the features of the subspecies *cineraceus*.

In 1891, "a few were seen at Furnace Creek" Ranch about the first of February and again April 9-12 (Fisher, 1893, pp. 142, 152).

121. **Polioptila cærulea obscura** Ridgway.

Western Gnatcatcher.

Noted at Furnace Creek Ranch in April every two or three days, more continuously after the middle of the month. First date of observance there, April 6; latest, April 29—both dates in 1917. From one to three of the birds would be checked in a two- or three-hour census; on April 14, 1920, six were counted in 2½ hours. Usually the birds were in mesquites; in fact only once was a Gnatcatcher seen in any other sort of plant, then in a creosote bush adjacent to mesquites.

A pair was noted in a tract of mesquites near Triangle Spring, —13 feet, each day, April 15 to 17, 1917; and a pair was seen in a mesquite at Salt Creek, —200 feet, April 3, 1920.

Seven specimens taken, nos. 28818-21, 40669-71. The first was a female taken April 6, and weighed 5.2 grams; the six males, taken April 10 to 21, weighed 5.2 to 6.2 grams (average 5.6). No evidences of actual nesting were obtained in Death Valley proper, though the species does breed in the Upper Sonoran zone of the mountain ranges adjacent.

In 1891, a Western Gnatcatcher was secured at Furnace Creek Ranch, January 24 (Fisher, 1893, pp. 143, 144, 152). This is now no. 136467, Biol. Surv. coll., U. S. Nat. Mus.

122. **Planesticus migratorius propinquus** (Ridgway).

Western Robin.

More or less common on Furnace Creek Ranch practically throughout April. The numbers noted day by day varied from as few as one or two up to 45. The latter number were checked during a three-hour census on April 20, 1920; most of the birds on that day and the next were foraging on the newly mown alfalfa fields where they were posed about as if on a lawn. Observed otherwise along the edges of the irrigation ditches, sometimes along the overflow streams among the mesquites below the ranch. One bird was seen (April 7, 1920) out on the wash-fan among desert holly bushes, a mile southeast of the ranch (—180 feet), in company with some Sage Thrashers. Two Robins were noted among mesquites near Salt Creek, —200 feet, April 3, 1920.

On April 6, 1920, and subsequently, an old Indian was seen on Furnace Creek Ranch hunting Robins with bow and arrow, but with what success I did not learn, as whatever was secured was promptly hustled out of sight. The first Robin song was heard on April 24, 1917; the temperature at the time registered 98° F. Three specimens secured: No. 28852, April 6, 1917, weight 79.0 grams; no. 28853, April 30, 1917, weight 73.6 grams; no. 40674, April 12, 1920, weight 64.8 grams. All were males, with testes small showing no near approach of the breeding season.

Mr. Dane Coolidge saw two Robins on a ploughed field on the ranch in December, 1919.

In 1891, "a few" Robins were seen at Furnace Creek Ranch the latter part of January and again on April 10 (Fisher, 1893, pp. 146, 147, 152).

123. **Sialia mexicana occidentalis** Townsend.

Western Bluebird.

Observed only as a casual visitant, at Furnace Creek Ranch. On April 22, 1917, just after sundown, a single male in the company of some Western Kingbirds, was seen to descend from high in the sky to the cottonwoods at the ranch. On April 8, 1920, about 7:30 a.m., a lone and very shy male was descried among the mesquites immediately to the north of the ranch. When persistently stalked it started off northward, mounting higher and higher into the sky until the eye could no longer hold it in view. As far as the evidence goes, it indicates that the Western Bluebird travels by daylight.

124. **Sialia currucoides** (Bechstein). Mountain Bluebird.

A lone individual was collected at Furnace Creek Ranch, April 4, 1920, where found flitting about a pile of mesquite cord-wood: No. 40675, ♂ (not in fullest plumage); weight, 27.5 grams.

In 1891, "a flock was seen at Mesquite Well, January 21". The species was common at Bennett Wells and Furnace Creek Ranch the last of January, at the last place "associated with titlarks and savanna sparrows in the alfalfa fields"; considered "a common winter resident" (Fisher, 1893, pp. 148, 149, 152). Three skins, all males, are preserved in the Biol. Surv. coll., U. S. Nat. Mus.: No. 136157, Bennett Wells, January 20, 1891; and nos. 136158, 136160, Furnace Creek [Ranch], January 30, 1891.

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VI

NOTES ON THE HEPATICÆ OF CALIFORNIA[1]

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The Hepaticæ of California were ably described in 1899 by Howe[2], who recognized eighty-five species and several distinct varieties. During the twenty-four years that have since elapsed, ten additional species from California have been recorded in the literature. Of these the following were proposed as new: *Aplozia pendletonii* Pearson, *Cephalozia patulifolia* Steph., *Fossombronia hispidissima* Steph., and *Scapania perlaxa* Warnst. The others are all northern species with an extensive geographical distribution.

Within the past few years Mrs. E. C. Sutliffe, of the California Academy of Sciences, has interested herself in the Hepaticæ and has collected diligently in several parts of the state. Her careful collections, supplemented by the collections made by various other students, have added eight more species to the flora of California. These and the additions already recorded in the literature are noted in the present report. Attention is likewise called to certain changes in nomenclature that affect the species of California, and a few species are critically discussed. Perhaps the most important

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[1] Contribution from the Osborn Botanical Laboratory.
[2] Mem. Torrey Club 7. 1899.

November 6, 1923.

of these are the species of Fossombronia, to which Mrs. Sutliffe has devoted particular care, but it must be admitted that our knowledge of these species is still far from adequate. In the arrangement of the notes Howe's sequence is followed throughout, and all page-references are to his work, unless otherwise noted.

1. **Riccia lescuriana** Aust. (p. 15)

It has recently been shown by Howe[3] that the correct name for this species is *R. beyrichiana* Hampe.

2. **Riccia minima** L. (p. 23)

Most writers now apply to this species the later name, *R. sorocarpa* Bisch. The reasons for doing so have been discussed by the writer.[4]

3. **Riccia americana** M. A. Howe (p. 24)

According to the later views of its author[5] the species should be considered a synonym of *R. austini* Steph.

4. **Riccia fluitans** L.

Lily Lake, Marin County, September, 1921, Mrs. Sutliffe. New to California. This widely distributed species has been reported also from the neighboring states of Nevada and Arizona and is described by Howe (p. 33).

5. **Neesiella rupestris** (Nees) Schiffn.

This species, which (in the writer's opinion) should be known as *Grimaldia rupestris* (Nees) Lindenb., has recently been reported from California by Conklin[6], the record being based on the following specimen: Santa Anita Canyon, San Gabriel Mountains, Los Angeles County, June, 1921, George L. Moxley 997. Through the kindness of Dr. Conklin the writer has had the privilege of examining this specimen and would refer it to *Cryptomitrium tenerum* (Hook.) Aust. (p. 45), rather than to the Grimaldia.

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[3] Bryologist 20: 34. 1917.
[4] See Rhodora 12: 195. 1910.
[5] North Am. Flora 14: 17. 1922.
[6] Bryologist 25: 23. 1922.

6. **Asterella violacea** (Aust.) Underw. (p. 53)

In the opinion of the writer[7] this species is a synonym of *A. bolanderi* (Aust.) Underw.

7. **Asterella gracilis** (F. Web.) Underw. (p. 56)

The writer[8] has recently discussed the synonymy of this species and shown that it should bear the name *A. ludwigii* (Schwaegr.) Underw.

8. **Lunularia cruciata** (L.) Dumort. (p. 60)

At the time Howe published his description of this introduced species it was known in North America in a gemmiparous condition only. A few years later Miss Julia T. Shinn[9] announced the discovery of fruiting material at Niles, California, and Mrs. Sutliffe, in the past year, has collected additional fruiting specimens in Mill Valley, Marin County. They grew, according to her label, "on damp banks beside steps forming a street."

9. **Sphærocarpos californicus** Aust. (p. 65)

Through the careful work of Miss Haynes[10] it has been proved that this species is a synonym of *S. texanus* Aust., which antedates *S. californicus* by two years.

10. **Riccardia major** Lindb. (p. 72)

In accrediting *R. major* to California Howe compared the species with *R. pinnatifida* (Nees) Trevis. and stated that the latter was distinguished by its "softer, flatter thallus, without indication of a unistratose margin," by "its looser texture," and by its dioicous inflorescence and smooth calyptra, the last two characters being quoted from other writers. In 1900 Schiffner[11] discussed "*Aneura pinnatifida* Nees" at length and showed that the species was an aggregate, based partly on tropical material and partly on European material. The tropical material, in his opinion, represented a species closely related to *R. multifida* (L.) S. F. Gray, while the European material agreed in great part with *Riccardia sinuata* (Dicks.) Trevis., a species antedating Nees von Esenbeck's species by a number of years. Schiffner therefore recommended that *Aneura pinnatifida* should no longer be recognized as a species and that the European specimens of the so-called *A. pinnatifida* should be definitely referred to *R. sinuata*. He showed further that the inflorescence of *R. sinuata* was autoicous (instead of being dioicous) and that the calyptra was covered over with inflated or tubular surface-cells (instead of being smooth), thus agreeing in these respects with *R. major* as described by Howe.

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[7] See Contr. U. S. Nat. Herb., 20: 303. 1920.
[8] Contr. U. S. Nat. Herb., 20: 269. 1920.
[9] Torreya 2: 124. 1902.
[10] Bull. Torrey Club 37: 223. 1910.

In connection with *R. sinuata* Schiffner discussed *R. major* and reached the conclusion that the two species were very close allies. At the same time he pointed out certain slight distinctions between them and suggested that they be recognized as distinct species, at least provisionally. His differential characters were drawn in part from the sporophyte and in part from the gametophyte. Six years later he[12] showed that the sporophytic differences were less constant than he had supposed but still insisted on the importance of the gametophytic differences and continued to regard *R. major* as a valid species. According to his account *R. sinuata* is a true aquatic; the thallus is rigid, fleshy and brittle and shows a bipinnate or tripinnate branching; the main axis is six to 10 cells thick, and the most delicate branches are never fewer than four or five cells thick; while the axis and leading branches broaden out at the apex. *R. major,* on the other hand, is a swamp plant rather than a true aquatic; the thallus is thinner and less rigid than in *R. sinuata* and shows a simply pinnate or rarely bipinnate branching; the main axis is only five cells thick on the more robust specimens, and the branches are only three or four cells thick; while the axis and branches never broaden out at the apex.

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[11] Lotos 48: 357-382. 1900.
[12] Oesterr. Bot. Zeitschr. 56: 170. 1906.

It will be seen that Schiffner's differential characters are based on variable features, and this is made still more evident by his remarks on a specimen of *R. major* collected by Howe at Duncan's Mills, Sonoma County, California. In this specimen the main axis is described as six cells thick and is said to broaden somewhat at the apex, thus showing (as Schiffner himself admits) an approach to *R. sinuata.* It is not surprising therefore that his conclusions regarding *R. sinuata* and *R. major* have not been universally accepted by European hepaticologists. Müller,[13] for example, does not accept them at all; in his opinion the differential characters are insufficient even for the establishment of a variety and he cites *A. major*[14] "mit ruhigem Gewissen" as a simple synonym of *A. sinuata* (Dicks.) Dumort. Macvicar,[15] on the other hand, accepts *A. major* as a valid species distinct from *A. sinuata.* At the same time he states that "it is doubtful how far" it "is permanently distinct" and cites a specimen from Sussex in which some of the thalli are bi- or tripinnate.

From the data in the literature and from the study of a large series of specimens the writer is inclined to regard *R. major* as a poorly developed form or variety of *R. sinuata,* rather than as a distinct species, its peculiarities being apparently associated with an unfavorable environment. It may be added that some of the material from California represents the more typical form of *R. sinuata,* the thalli being often tripinnate and the main axis seven to nine cells in thickness. This is true, for example, of the two specimens collected by Mrs. Sutliffe in 1922 at the following stations: Big Carson Canyon and Mt. Tamalpais, both in Marin County.

11. **Fossombronia hispidissima** Steph. Mém. Herb. Boissier 16: 35. 1900

Mill Valley, Marin County, Mrs. Sutliffe; near Stanford University, Santa Clara County, C. F. Baker (determined by Stephani and distributed in Pacific Slope Bryophytes, No. 453); Arroyo Grande, San Luis Obispo County, O. D. Allen; Libby Park, Ojai, Ventura County, Miss C. C. Haynes.

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[13] Rabenhorst's Kryptogamen-Flora 6: 340. 1908.

[14] The combination, "*Aneura major*," was apparently first used by the writer in connection with a specimen from Alaska (see Zoe 5: 129. 1901).

[15] Student's Handb. British Hep. 55. 1912.

In his treatment of the genus Fossombronia, Howe (p. 80) referred all his Californian material to *F. longiseta*. In doing this he assigned to the species a wide range of variation in the surface-markings of the spores. At one extreme the spores (as shown in figs. 16, 18 and 19) were of the cristate type, the markings being in the form of narrow, subparallel ridges, sometimes anastomosing irregularly but rarely forming closed meshes. At the other extreme the spores (as shown in figs. 17 and 20) approached the echinate type, the ridges being broken up more or less completely into spines. These extremes were so different that Howe admitted the possibility of there being more than one species included in what he called *F. longiseta;* he stated, however, that he could not "draw separating lines in any satisfactory way," owing to the apparent existence of intermediate types of spores. At the same time he emphasized the fact that all his specimens "from stations north of San Francisco" had "spores of the purely cristate type."

In Stephani's monograph of Fossombronia, published the year after Howe's work, he proposed *F. hispidissima* as a new species and discussed Howe's figures of *F. longiseta*. In his opinion the differences shown were too great to fall within the limits of a single species and he recognized three species, *F. hispidissima, F. longiseta* and *F. pusilla,* as members of the Californian flora. To the first he assigned hispid spores, to the second reticulate spores, and to the third cristate spores.

The writer has examined many specimens of Fossombronia from various parts of California, but has not seen any in which the spores were reticulate. Spores of this type, moreover, are not shown in Howe's figures. Stephani's *"F. longiseta,"* therefore, must remain uncertain in the absence of the specimen upon which his description was based. However this may be, it seems advisable to recognize *F. hispidissima* as a valid species, even if the surface-markings of the spores are not invariably in the form of discrete spines.

As the writer understands the species, the spores measure 30-40µ in diameter, and the periphery of the spherical face shows about forty projections measuring 3-4μ in length. These projections sometimes represent actual slender cones tapering to sharp points. In other cases they may represent the optical sections of narrow ridges extending for a variable but short distance from the periphery toward the center of the spherical face. In exceptional cases a series of such ridges may be distinctly parallel when a spore is viewed sidewise, but this appearance is no longer to be made out when the spherical face is turned toward the observer's eye. Except for these occasional parallel ridges the thickenings of the spore wall are exceedingly irregular and consist of sharp slender cones or short and narrow ridges closely crowded together and showing no indications of closed meshes. Although ridges may be evident even in the median portion of the spherical face they are so short and so irregular that they look very different from the longer and anastomosing ridges seen in a spore of the cristate type. Howe's figs. 17 and 20 clearly represent *F. hispidissima.* Fig. 20 was drawn from a specimen collected by A. J. McClatchie at Pasadena, so that this locality also may be cited for the species. Fig. 17 was drawn from a plant which Howe thought might have represented a portion of Howe's original material of *F. longiseta.* It came from the Austin collection but no data were given regarding its collector or the part of California where it was found. The type specimen of *F. hispidissima,* collected at San Francisco by Bolander, has not been seen by the writer.

The occurrence of ridges on spores of the echinate type is by no means unusual. Even in *F. cæspitiformis* (Raddi) De Not. of southern Europe and neighboring regions, which is one of the most distinct species with spores of this character, the projections are really short ridges truncate at the tips; and these ridges, in Schiffner's var. *subcristata,*[16] have often a considerable length and give the spores an approximately cristate appearance, especially when viewed from the side. In another echinate species, the rare *F. mittenii* Tindall[17] of Devonshire, England, the projections are again in the form of short ridges with rounded, truncate or even emarginate apices. The European species which seems to come closest to *F. hispidissima* is

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[16] Verhandl. Zool.-Bot. Ges. Wien **59**: 34. 1909.
[17] Jour. Bot. **36**: 44. *pl. 282* B. 1898.

F. echinata Macvicar,[18] based on material from Algeria, Dalmatia and southern Italy and since reported by Casares Gil from Spain.[19] In this species the spores are described as densely hispid, the individual projections being 2-4µ long and acute or subacute at the tips. No intimation is made in the published descriptions that any of the projections are ever in the form of ridges, so that Macvicar's species must show the echinate condition in an especially typical way.

12. **Fossombronia longiseta** Aust. (p. 80)

"California", without definite locality, H. N. Bolander (distributed in Austin's Hep. Bor.-Amer. No. 118); Mill Valley, Marin County, M. A. Howe (distributed in Underwood & Cook's Hep. Amer. No. 157); same locality, Mrs. Sutliffe (a series of specimens); Mt. Tamalpais, Marin County, M. A. Howe 6; Yosemite Valley, Mariposa County, A. W. Evans; Ione, Amador County, Miss Alice Eastwood; Spencer Valley, San Diego County, L. Abrams 3800; Claremost, Los Angeles County, P. A. Munz 4727. This list is based on the specimens in the Yale Herbarium; Howe gives several additional localities for the species, but it is possible that some of his records are based on what is here called *F. hispidissima.* Outside of California the only station for *F. longiseta* known to the writer is Cherry Creek, Santa Catalina Mountains, Arizona, G. E. Nichols.[20]

The segregation of *F. hispidissima* as a species leaves a residue of California Fossombroniæ in which the spores conform to the cristate type. Unfortunately, these cristate spores vary markedly in the number of ridges that they show, this number being most conveniently estimated for comparative purposes by counting the projections at the periphery of the spherical face. In the specimens distributed by Austin in his Hepaticæ Boreali-Americanæ there are usually from 22 to 26 of these projections. Since these spore-bearing specimens were issued by Austin himself they may well be regarded as authentic representatives of *F. longiseta,* especially in the absence of an actual type specimen, to which Howe calls attention. Some of the specimens collected by Mrs. Sutliffe in Mill Valley conform pretty closely to these numbers, one having spores with 24 to 27 projections, another with 21 to 24, and still another with 18 to 24. In other Californian material, however, the spores show from 16 to 20 projections; this is the case, for example, in Howe's No. 6 from Mt. Tamalpais and in Abrams' specimen from Spencer Valley. In still other material the spores have from 26 to 32 projections, as in one of Mrs. Sutliffe's Mill Valley specimens and in Miss Eastwood's specimens from Ione. These variations in the number of ridges are shown clearly in Howe's figs. 16, 18 and 19.

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[18] Rev. Bryol **38**: 73 *f. l.* 1911.
[19] Trab. Mus. Nac. Cien. Nat. Ser. Bot. **8**: 25. 1915.
[20] See Evans, Bryologist **20**: 61. 1917.

In Europe the two best known species with cristate spores are *F. pusilla* (L.) Dumort. and *F. wondraczeki* (Corda) Dumort. In *F. pusilla* the number of peripheral projections is given as 16 to 18 by Müller and as 16 to 24 by Macvicar. In *F. wondraczeki* the numbers are 30 to 32 and 28 to 36, respectively. There is no evidence that these species intergrade, and *F. wondraczeki* seems to be perfectly constant in eastern North America, where *F. pusilla* is apparently unrepresented. It will be noticed that the Californian specimens include forms with just as few spore-ridges as *F. pusilla,* others with as many as *F. wondraczeki,* and still others with an intermediate number. It might therefore at first appear as if three species were present, *F. pusilla, F. wondraczeki* and a species between them, for which the name *F. longiseta* could be retained. It would, however, be difficult, if not impossible, to tell where *F. longiseta* ended and the other species began, owing to the fact that the number of ridges in the intermediate type of spore tends to vary toward both extremes.

In view of these facts it seems advisable to search for differential characters in the gametophyte. It is well known that the leaves in the various species of Fossombronia are unfortunately very inconstant in size, in shape and in the character of their lobing, and that the pseudoperianths are equally inconstant in their features, so that little can be hoped for here. Differences in habit, however, seem to be more trustworthy and apparently these can be utilized in the present instance. In northern Europe, for example, *F. pusilla* and *F. wondraczeki* seem to be definitely annuals, producing their spores in the late summer and early autumn and presenting no gametophytic adaptations for carrying them through the winter. They thus stand in sharp contrast to such species as *F. angulosa* Raddi, which produce their spores in the late winter or spring and which seem to be definitely perennials. So far as observations go the Californian Fossombroniæ are all perennial and even, in some cases, produce tuberous thickenings of the stem, enabling them to withstand periods of dryness. If this perennial habit proves constant the writer suggests that the name *F. longiseta* be retained for all cristate-spored forms of the region and that a range in the number of peripheral projections from 18 to 32 be admitted. Of course, if it should be demonstrated that the perennial habit or the power to produce tubers was restricted to forms having a more limited range in the number of surface-ridges, a segregation might be indicated.

It should be mentioned in this connection that the spores with few ridges in the Californian specimens, although simulating those of *F. pusilla* in a marked degree, do not absolutely agree with them, owing to the fact that the ridges are only 2-3µ high, while those of *F. pusilla* are usually 3-5µ high and may be as much as 7µ high in the case of the var. *decipiens* Corbière. Since, however, the ridges in poorly developed plants of *F. pusilla* are often lower, this distinction must be used with caution. It should be mentioned also that Schiffner has recently described and figured, under the name *F. loitlesbergeri*,[21] a perennial species from Dalmatia with cristate spores, in which the number of marginal projections is about 25. The spores thus occupy, so far as the number of ridges is concerned, an intermediate position between those of *F. pusilla* and those of *F. wondraczeki*. Although at first sight *F. loitlesbergeri* might seem to approach *F. longiseta* very closely, its spores are considerably larger, measuring 50-60µ in diameter, and the ridges are 6-7µ high. Since the spores of *F. longiseta* are only 40-50µ in diameter and since the ridges are only 2-3µ high the two species seem to be amply distinct.

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[21] Hedwigia 48: 195. *f. 1-14.* 1909.

13. **Fossombronia pusilla** (L.) Dumort.

Stephani's record for California[22] was based on specimens collected by Howe, no definite station being mentioned. These particular specimens have not been available for study, but the writer feels convinced that they must represent some form of *F. longiseta,* probably a form in which the number of ridges on the spores was relatively small. Spores of this character are represented in Howe's fig. 18, drawn from a Mill Valley specimen. Until it is definitely established that such spores are associated with annual gametophytes, there seems to be no conclusive reason why *F. pusilla* should be considered a member of the Californian flora. In fact, the occurrence of the species in North America is very doubtful, all the records (so far as known) being based on sterile or incorrectly determined specimens.

14. **Marsupella sullivantii** (De Not.) Evans

On rocks. Gold Lake, Plumas County, September, 1900, J. B. Leiberg 5496. New to California; widely distributed in northern countries and previously reported from Washington.

15. **Nardia crenulata** (Sm.) Lindb. (p. 94)

In the writer's opinion the true *N. crenulata* has not yet been found in the western part of North America. It is replaced in the Pacific Coast region by the closely related *N. rubra* (Gottsche) Evans,[23] a species which Howe included among the synonyms of *N. crenulata.*

16. **Nardia obovata** (Nees) Lindb. (p. 96)

The writer feels convinced that the specimens from Blue Lake, Humboldt County, upon which Howe's record was based, represent *Jungermannia sphærocarpa* Hook. or some closely related species.[24] Unfortunately the specimens are too fragmentary for a positive determination, more especially since *J. sphærocarpa* is otherwise unknown from California.

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[22] Mém. Herb. Boissier **16**: 25. 1900.
[23] See Bryologist **22**: 62. 1919.
[24] See Rhodora **21**: 163. 1919.

17. **Jungermannia lanceolata** L.

On wet soil along a stream, Lower Salmon Lake, Sierra County, October, 1921, Mrs. Sutliffe. New to California; widely distributed in northern regions and previously known from Washington.

18. **Jungermannia pendletonii** (Pearson) comb. nov.

Aplozia pendletonii Pearson, Bryologist **23**: 50. pl. 2. 1920

This interesting species was discovered by George M. Pendleton on the western side of Mt. Shasta, at an altitude of 4000 feet. Specimens collected on May 8, 1910, were distributed by Miss Haynes in her American Hepaticæ (No. 90), under the name *Jungermannia cordifolia* Hook.; the type specimens were collected on August 4, 1917; and still other material is dated April 16, 1919. Only the 1910 and 1919 specimens have been examined by the writer.

Although *J. pendletonii* is amply distinct from *J. cordifolia* the two species resemble each other very strongly, especially when well developed. Both are characterized by a tufted habit and a dark green color, often blackish when dry and sometimes tinged with a purplish, brownish, or brownish red pigmentation; both show occasional terminal branches of the Frullania type and also intercalary branches, the latter arising near the ventral bases of the leaves; and the leaves in both tend to assume a suberect position, clasping and partially concealing the stem.

When the leaves are dissected off and spread out flat certain differences at once become apparent. In *J. cordifolia* the leaves are broadest just above the base and then taper gradually but distinctly to a rounded apex. They are usually described as "heart-shaped," but the basal portion is rounded on the sides rather than cordate and is even very slightly decurrent. The leaf-cells are characterized by their thin but often pigmented walls, by the almost complete absence of trigones, and usually by the presence of delicate striolations on the cuticle. In some cases, especially toward the margins of the leaves, very minute trigones with concave sides can be demonstrated, but they are so indistinct that they are practically negligible. In *J. pendletonii* the leaves are approximately orbicular and do not show the tapering found in *J. cordifolia,* although the rounded basal portions are not dissimilar in the two species. The leaf-cells yield further distinctions. In *J. pendletonii* the median cells are mostly 40-50µ long and 25-30µ wide, while the marginal cells are 27-32µ in diameter; in *J. cordifolia* the median cells are mostly 40-45× 20-30µ, while the marginal cells are only 20-23µ in diameter, the cells thus showing a more marked decrease in size in passing from the median portion outward. In *J. pendletonii,* moreover, it is usually possible to demonstrate distinct trigones, especially in the marginal portions of the leaves, but the striolations are very indistinct although not entirely absent.

Pearson emphasizes as a characteristic feature of his species the presence of two layers of cells in the basal portion of the leaf, the two layers not being "regularly arranged cell on cell" but crossing each other. This two-layered portion does not stretch entirely across the leaf but occupies a vaguely defined area toward the ventral side. In poorly developed leaves the area is much reduced in size and may be absent altogether. Just how distinctive this feature really is remains to be determined, since very few species of Jungermannia have been studied from this particular point of view. It is not, however, absolutely distinctive. The robust Norwegian material of *J. cordifolia,* for example, collected by E. Jörgensen at Gulen in Sördfjord and distributed in Schiffner's Hepaticæ europaeæ (No. 394), shows small basal leaf areas where the cells are in two layers; and the same thing is true of some of the more vigorous North American specimens examined by the writer. None of these, however, are comparable in distinctness with the much larger areas found in *J. pendletonii.*

The male inflorescence of *J. pendletonii* was unknown to Pearson, but he described the perichætial bracts and perianths and illustrated them in a supplementary note.[25] According to his account the perianths are considerably shorter than the bracts, and yet he regards them as "normal-sized and perfect." They are said to be four- or five-plicate in the upper part, abruptly contracted at the mouth, and entirely free from the bracts, the latter being similar to the leaves. The writer is unable to add to this description, since the specimens at his disposal are wholly sterile, but it seems hardly probable that the perianths studied by Pearson were associated with fertilized archegonia.

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[25] Bryologist **23**: 84, 85. *f. 1-3.* 1920.

The Californian species of Jungermannia are in need of further study. In September, 1866, Bolander discovered two species, *J. bolanderi* Gottsche and *J. danicola* Gottsche, on Mt. Dana, at an altitude of about 3100 meters. Neither of these species has since been collected, and our knowledge concerning them is still unsatisfactory, as Howe has pointed out (pages 99 and 101). According to his descriptions and Gottsche's figures,[26] *J. danicola* is paroicous and is evidently a member of the *J. sphærocarpa* group. *J. bolanderi,* on the contrary, may be an ally of *J. pendletonii,* and Pearson in a recent letter expressed the fear that the two species might prove synonymous. A very fragmentary specimen of *J. bolanderi* in the herbarium of the New York Botanical Garden shows that this is probably not the case. The leaves do not show a two-layered area; neither do they clasp the stem, but spread obliquely, as Gottsche's figures show. Howe's description of the perianth in an immature condition is much like Pearson's account of that organ in *J. pendletonii,* but fully developed perianths might perhaps yield distinctive characters.

19. **Jungermannia riparia** Tayl.

In the rocky bed of a stream, near Willoughby Mine, Sierra County, October, 1921, Mrs. Sutliffe; near Shasta Retreat, Siskiyou County, September 1, 1922. Miss Eastwood. New to California; widely distributed in Europe but previously known in North America from British Columbia and Washington only.

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[26] Published by Underwood, Bot. Gaz. **13**: *pl. 3, 5.* 1888.

20. **Lophozia baueriana** Schiffn.

Reported from California by Conklin,[27] the record being based on a specimen collected at Sisson by George M. Pendleton. By most writers *L. baueriana* is now regarded as a synonym of *L. hatcheri* (Evans) Steph.

21. **Lophozia exisa** (Dicks.) Dumort.

Lake Lagunitas, Marin County, March, 1922, Mrs. M. L. Campbell 2, in part. New to California; widely distributed in northern regions and previously known from Washington.

22. **Lophozia hornschuchiana** (Nees) Schiffn.

On moist earth, decayed wood and rocks, Lower Salmon Lake and vicinity, October, 1921, Mrs. Sutliffe (nine specimens). New to California; widely distributed in northern regions and previously known from Oregon and northward.

23. **Lophozia ovata** (Dicks.) M. A. Howe (page 111)

Most recent writers refer this species to the genus Diplophyllum, where it appears under the name *D. ovatum* (Dicks.) Steph.[28]

24. **Chiloscyphus polyanthos** (L.) Corda (p. 118)

If Schiffner's recent segregations[29] are accepted the occurrence of the true *C. polyanthos* in California must be regarded as doubtful. The genus is represented in the state, however, by the three species cited below. Some of the specimens enumerated are listed by Howe under the typical form of the species and others under *C. polyanthos rivularis* (Schrad.) Nees (p. 119). Several of Howe's specimens have not been seen by the writer.

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[27] Bryologist **15**: 11. 1912.

[28] See Miss Haynes, Bryologist **21**: 89. 1918.

[29] See Beih. Bot. Centralbl. **29**^{2}: 74-116-*pl. 1, 2.* 1912.

25. **Chiloscyphus fragilis** (Roth) Schiffn.

Without definite locality, H. N. Bolander; Yosemite Valley, C. M. Cooke.[30]

26. **Chiloscyphus pallescens** (Ehrh.) Dumort.

On wet logs, Big Valley Mountains, Modoc County, M. S. Baker and F. P. Nutting.

27. **Chiloscyphus rivularis** (Schrad.) Loeske.

Without definite locality, H. N. Bolander; Humboldt County, Miss K. Inglis; near Lake Lagunitas, Marin County, Mrs. Sutliffe; Sacramento River, near Sisson, Siskiyou County, M. A. Howe (specimens from this locality were distributed in Underwood & Cook's Hep. Amer., No. 170, as *C. polyanthos rivularis)*; McCloud River country, Siskiyou County and near Shasta Retreat, Siskiyou County, Miss Eastwood; near Salmon, Horse and Packer Lakes, Sierra County, Mrs. Sutliffe (six specimens); Horse Corral Meadows and vicinity, Tulare County, F. J. Coulter (five specimens).

28. **Cephalozia affinis** Lindb.

Reported from California by the writer,[31] the record being based on specimens collected by G. M. Pendleton at Sisson, Siskiyou County.

29. **Cephalozia divaricata** (Sm.) Dumort. (p. 127)

During recent years "*C. divaricata*" and its allies have been intensively studied, especially by the European hepaticologists Schiffner and Douin. As a result of his investigations Douin reached the conclusion that this group of plants was not only generically distinct from Cephalozia but that it represented a distinct and well-marked family, to which he gave the name Cephaloziellaceæ. He distinguishes six genera, only two of which, Cephaloziella and Prionolobus, are recognized members of the California flora. His latest paper dealing with the group was published in 1920[32] and has been of great help to the writer in determining the Californian material. Howe's "*Cephalozia divaricata*" is listed below (at least in part) under the name *Cephaloziella byssacea,* while his var. *scabra* (p. 129) is regarded as a synonym of *C. papillosa.* Two other species are reported for the first time from the state, and a fifth species, *C. palulifolia,* although unknown to the writer, is briefly alluded to.

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[30] See Evans, Rhodora **14**: 218. 1912.
[31] Bryologist **17**: 89, 1914.

30. **Cephaloziella byssacea** (Roth) Warnst.

Without definite localities, H. N. Bolander (several specimens); "Mission Hills," H. N. Bolander; Yosemite Valley, A. W. Evans.

31. **Cephaloziella hampeana** (Nees) Schiffn.

On banks, Wheeler's Sulphur Springs, Ventura County, February, 1921, Miss C. C. Haynes 2041. New to California, but widely distributed in Europe and in most parts of North America.

32. **Cephaloziella limprichtii** Warnst.

On earth, Mill Valley, Marin County, February, 1922, Mrs. M. L. Campbell 3. New to California; widely distributed in northern regions but heretofore known from very few North American localities. The synonymy of the species is greatly confused.

33. **Cephaloziella papillosa** (Douin) Schiffn.

Cazadero, Sonoma County, M. A. Howe; Mill Valley and Lake Lagunitas, Marin County, M. A. Howe; Muir Woods (Redwood Canyon), Marin County, Mrs. M. L. Campbell. Howe's specimens were determined by Douin.

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[32] Mém. Soc. Bot. France 29: 1-90. *f. 1-9.* 1920.

34. **Cephaloziella patulifolia** (Steph.) Douin, Mém. Soc. Bot. France 29: 70. 1920

Cephalozia patulifolia Steph. Bull. Herb. Boissier II. **8**: 509

This species was based on a specimen collected in California by Bolander, no more definite locality being mentioned in the published descriptions. Through the kindness of Mr. Maxon the writer has had the privilege of studying Bolander's Cephaloziellæ in the U. S. National Herbarium but has found nothing that agrees with Stephani's or Douin's account. According to the latter writer *C. patulifolia* agrees with *C. papillosa* in having rough leaves and underleaves but differs in its autoicous inflorescence. Stephani quotes Howe's var. *scabra* as a possible synonym of *C. patulifolia* but Douin cites it definitely under *C. papillosa.*

35. **Cephalozia Turneri** (Hook.) Lindb. (p. 129)

This species is a representative of the genus Prionolobus and may be known as *P. turneri* (Hook.) Schiffn.

36. **Scapania heterophylla** M. A. Howe (p. 155)

This interesting Scapania is still known only from the type locality, Sisson, Siskiyou County, where it was collected on submerged stones in a mountain stream by Howe in 1894. Since its description by Howe it has been studied by Müller,[33] by Stephani[34] and by Warnstorf.[35] Müller admitted its validity but recognized its close relationship to *S. undulata* (L.) Dumort. Stephani regarded it as "ganz deformiert" and suggested that it might perhaps be referable to some other species of the genus, without attempting to settle the matter definitely. Warnstorf went still further and reduced it to varietal rank under *S. undulata,* its name thus becoming *S. undulata* var. *heterophylla* (M. A. Howe) Warnst. In his opinion the uninjured leaves at the tips of the stems and branches are quite indistinguishable from those of *S. undulata,* and for this reason he considers the reduction justifiable. He makes no mention, however, of the unlobed leaves, which Howe describes as interpolated among the more normal bilobed leaves. Until the significance of these is more fully understood, it seems wisest to keep *S. heterophylla* distinct from *S. undulata.*

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[33] Nova Acta Kais. Leop.-Carol. Akad. Naturf. **83**: 137. 1905.
[34] Sp. Hepat. **4**: 138. 1910.
[35] Hedwigia **63**: 111. 1921.

37. **Scapania perlaxa** Warnst. Hedwigia 63: 70. 1921

The type specimen of this species is preserved in the Botanical Museum at Berlin-Dahlem and was collected by Bolander on wet granite rocks in the Yosemite Valley. The writer has as yet been unable to examine this specimen and has seen no material of Bolander's that agrees with Warnstorf's description, although all the Californian Scapaniæ in the U. S. National Herbarium have been available for study. According to its author, *S. perlaxa* bears a resemblance to *S. geniculata* Massal., a species which Arnell[36] considers a synonym of *S. helvetica* Gottsche and scarcely distinct from the widely distributed *S. irrigua* (Nees) Dumort. The distinctive features emphasized by Warnstorf are the rounded and entire leaf-lobes, the hydrophytic habit, the distant leaves, and the long flagelliform branches. The implied absence of trigones in the leaf-cells might seem to indicate an approach to *S. undulata,* but further studies are clearly necessary before the relationships of the species are adequately established.

38. **Scapania subalpina** (Nees) Dumort.

First recorded from California by Müller,[37] the following two stations being cited: Yosemite Valley, bank of the Merced River, H. N. Bolander, and Sierras, June, 1864, W. H. Brewer. It is now possible to report the species from three additional localities, namely: "wet bank of stream flowing out of Deer Lake, Sierra County, 6950 ft. alt.," Mrs. Sutliffe; Horse Corral Hill and East Fork of Clover Creek, Tulare County, F. J. Coulter.

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[36] Schwedish. Art. Diplophyllum u. Martinellia 37. 1922.
[37] Nova Acta Kais. Leop.-Carol. Akad. Naturf. 83: 69. 1905.

39. **Porella rivularis** (Nees) Trevis.

The correct name for this species seems to be *P. cordæana* (Hüben.) Evans.[38]

The additions and subtractions recorded in the preceding notes represent a net addition of 16 species to the flora of California since the date of Howe's work. The total number of species now known from the state is thus increased to 101.

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[38] See Bryologist 22: 72. 1919.

PROCEEDINGS

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VII

FRESHWATER MOLLUSKS OF EAGLE LAKE, CALIFORNIA

BY

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The present paper is based on a collection of freshwater mollusks which was obtained in Eagle Lake, California, in June, 1923, by Mr. Joseph Mailliard, Curator of Ornithology, California Academy of Sciences. When Mr. Mailliard announced his intention of working in that general region during the early summer, special request was made for him to examine the shores of the lake and collect some shells, if possible. He very kindly went out of his way to do this and was rewarded by securing the material enumerated below. The number of species collected is not large, but in most cases they are represented by many specimens.

Eagle Lake is the lowest point of a small isolated drainage basin in the lava area of Lassen County, northeastern California. It is very irregular in outline but approximately twelve miles long and eight miles wide at the widest part. Pine Creek is the only named tributary and there is no surface outlet. It as been described as " . . . large, deep and irregular in outline. Apparently it was once a tributary to Lake Lahontan but is now separated from Honey Lake Basin by a wall of permeable rock, from the base of which many springs unite to form a branch of Susan Creek. The water of Eagle Lake is clear and cold. The western and southern shores are largely forested. The surface level is subject to periodical fluctuations, recently rising so high as to submerge a considerable area and kill many large conifers."[1]

Professor Snyder determined from a study of the fishes that the lake once formed a part of the vast Lake Lahontan Basin and the intimate relationship thus established calls for a comprehensive biological study which cannot here be attempted. The origin, development, subsidence and physical characteristics of Lake Lahontan have been philosophically described by I. C. Russell in 1885.[2] A summary of his conclusions (p. 250) and his map were reproduced by Professor Snyder, who found evidence among the fishes to warrant the questioning of the "second complete dessication" of the basin so far as Pyramid and Winnemucca lakes are concerned. The mollusks furnish further evidence which indicates that these two did not completely disappear during the last subsidence.

A comprehensive study of the living and fossil mollusks of the entire Lahontan Basin is badly needed to secure data for geological correlation. We know that in it flourished a remarkable fauna of a few very prolific species. These belonged to genera which were widespread in the west during Pliocene and Pleistocene time. Carinifex was probably the most widely dispersed of all, although Parapholyx, Lanx and Vorticifex occurred over large areas. The vast change of climate during the epochs mentioned caused equally great changes in much of the fauna; most noticeable of these is probably that of the mammals as shown by the bones in tar pits of southern California.

The great lake systems of California, Oregon, Idaho and Nevada have largely disappeared on account of the present period of extreme drouth. But they have left a few remnants, here and there, in which mollusks continue to thrive and these are as interesting to the conchologist as the sabertooth tiger and the ground sloth are to the mammalogist. The present lake basins are insular in character and display, in their isolation, many of the features of oceanic islands. This is well brought out by Professor Snyder in his study of the fishes and is probably true of several other aquatic groups of animals as well.

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[1] Snyder, J. O., Bull. U. S. Bureau Fisheries, Vol 35, Doc. 843, 1917, p. 34. "The Fisheries of the Lahontan System of Nevada and Northeastern California." Many references to pertinent literature are contained in this paper.

[2] U. S. Geol. Surv. Monograph 11, 1885.

Since mollusk shells can be had in some cases from the earliest sediments deposited in the basins to the present time, these organisms furnish an excellent opportunity to study questions of variation due to changes in salinity and passing time. But, unfortunately, the field work for such undertaking has been far too meager for generalization. Almost the only collections heretofore made in the region have been picked up incidentally by persons engaged in other work. Eagle Lake is one of the more important of these residual bodies of water but almost nothing is known of its geological history. That it has retained at least a portion of its fauna through part of the great lava flow of northeastern California is significant in itself.

The mollusks of the lake have scarcely been noticed if one may judge by available records. The Carinifex which lives there has been referred to twice, first as genus only by Stearns in 1891.[3] The next record as *C. newberryi* is by Pilsbry in 1899,[4] from collections made by R. C. McGregor, then doing work for the U. S. Bureau of Fisheries. The latter also collected *Goniobasis nigrina* (Lea) in a small spring near the lake and *G. acutifilosa* Stearns and *Fluminicola seminalis* (Hinds) in a small creek at the lake. Further than these I know of no records.

1. **Carinifex occidentalis** Hanna, new species

Plate 1, figures 1-9

Shell similar to *C. newberryi* (Lea) but smaller for same number of whorls, axial sculpture very much finer, and color much paler; the type has 4¼ whorls including the rounded nuclear whorl; all except this have a sharp carina on the upper shoulder which is indistinctly beaded by crossing of axial sculpture; shoulder very slightly concave; umbilicus wide and bounded externally by a sharp carina. Diameter of type, 13.5 mm.; altitude, 9.3 mm.; diameter of umbilicus 6 mm.

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[3] Nautilus, Vol. 4, 1891, p. 122.

[4] Nautilus, Vol. 13, 1899, p. 65.

Type: No. 1610 and paratypes Nos. 1611-1618, Mus. Calif. Acad. Sci., collected by Mr. Joseph Mailliard in June, 1923, in **Eagle Lake, Lassen County, California.**

My attention was called to this species in 1920 by Mr. Barbat who, with Mr. T. C. West of the U. S. Forest Service, collected a few specimens near Galatin on Eagle Lake. The large collection brought in by Mr. Mailliard consists of 479 specimens. Considerable variation in shape is shown in the series and the extremes are figured to aid in recognition. In no case did there appear to be a tendency toward malleation of the shell, a character sometimes attributed to changing salinity of the habitat.

For some time I have had in preparation a review of the species of the genus Carinifex and, pending its publication, it will be sufficient to state that the Eagle Lake species is most like *C. newberryi* of the described forms. That species is the type of the genus and has a larger, heavier, darker and more coarsely sculptured shell. The type specimen, figured by Binney, evidently came from "Canoe Creek," California (now called Hat Creek, a tributary of Pit River) and not from Klamath Lake. The species from the latter place was described by E. A. Smith as *C. ponsonbii;* the form in Clear Lake was named *C. newberryi minor* by Cooper but is one of the most distinct species.

1. **Parapholyx mailliardi** Hanna, new species

Plate 1, figures 10-24

Shell large and robust, spire depressed, consisting of about 2¾ whorls; marked in type specimen only with fine regular lines of growth, grouped into irregular ridges near the aperture; in other specimens (as figures show) heavy costæ may be developed; imperforate; columella slightly thickened;

peristome broadly reflected but with sharp margin. Diameter of type, 13.4 mm.; altitude, 9.3 mm.

Type: No. 1619; paratypes, Nos. 1620-1634, Mus. Calif. Acad. Sci., collected by Mr. Joseph Mailliard in June, 1923, in **Eagle Lake, Lassen County, California.**

The large size, depressed spire and reflected peristome serve to distinguish this species from others of the genus. Variation in strength of costæ is excessive and parallels a case Hemphill found in shells from the Columbia River, Oregon, at The Dalles. The same is true of shells from Pyramid Lake, Nevada, and the Lahontan Basin generally. *P. effusa* (Lea), type of the genus from the Sacramento River, does not appear ever to be costate.

In all, 250 specimens were secured by Mr. Mailliard for whom the species is named.

3. **Planorbis parvus** Say

The collection contains seventy-five specimens from Eagle Lake, which have been referred to this species. They agree in shape and size with material from a large number of localities in California and Oregon. Equally worthy of note is the fact that constant differences are displayed in the aperture from *P. scabiosus,* as pointed out under the description of that form.[5]

4. **Valvata humeralis** Say

Over 200 specimens were collected in Eagle Lake. They are remarkably uniform in shape throughout, in marked contrast with *V. utahensis* Call[6] and *V. oregonensis* Hanna[7], which inhabited nearby lakes in a previous geological period. Living examples collected by Hemphill at Old Mission, Idaho, are not distinct from those from Eagle Lake. In placing the species under *humeralis* I believe I am in accord with the views of Dr. Bryant Walker, who found the species in

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[5] *Planorbis scabiosus* Hanna, Univ. Oregon Publ., Vol.1, No. 12, 1922, p. (4), pl. 1, figs. 4-6; Pliocene, Warner Lake beds, eastern Oregon.

[6] Call, U. S. Geol. Surv. Bull. 11, 1884, p. 44, pl. 6, figs. 1-3.

Utah.[8] Mr. Hannibal likewise was of the opinion that the widespread Valvata of the west was referable to *humeralis*.[9] Dr. Pilsbry stated[10] that it is a Mexican species and was led to "expect it in suitable places over a considerable territory within our limits. It is quite unlike *V. virens* of the Rocky Mountain region, having more in common with the northern *V. sincera* Say." I have compared it directly with a large collection of *V. virens* from Clear Lake, California, the type locality; the latter species has a high spire and narrow umbilicus, while the Eagle Lake specimens are more like *V. sincera* as figured by Walker[11] from Anticosti.

5. **Physa,** species?

A single specimen of Physa occurs in the collection from Eagle Lake. It is not fully adult but is evidently one of the smooth forms. Nomenclature in this genus is so hopelessly confused that identification with named species becomes little more than guess work and the naming of additional ones, be they valid or otherwise, only adds to the difficulties. The same is true of the members of the following genus.

6. **Pisidium,** species?

The collection contains thirteen valves of a species of Pisidium from Eagle Lake. Whether it is a named form or not is impossible to determine at this time. The group, like Physa, needs a competent monographer, and until he arrives it would seem best not to add to his difficulties by naming one or more unrecognizable species out of each lot collected, as sometimes has been done.

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[7] Hanna, Univ. Oregon Publ., Vol. 1, No. 12, 1922, p. (11) pl. 3, figs. 1-8, pl. 4, figs. 1-4.

[8] Nautilus, Vol. 20, 1906, p. 26.

[9] Nautilus, Vol. 23, 1910, p. 105.

[10] Nautilus, Vol. 19, 1906, p. 105.

[11] Nautilus, Vol. 20, 1906, pl. 1, figs. 4-6.

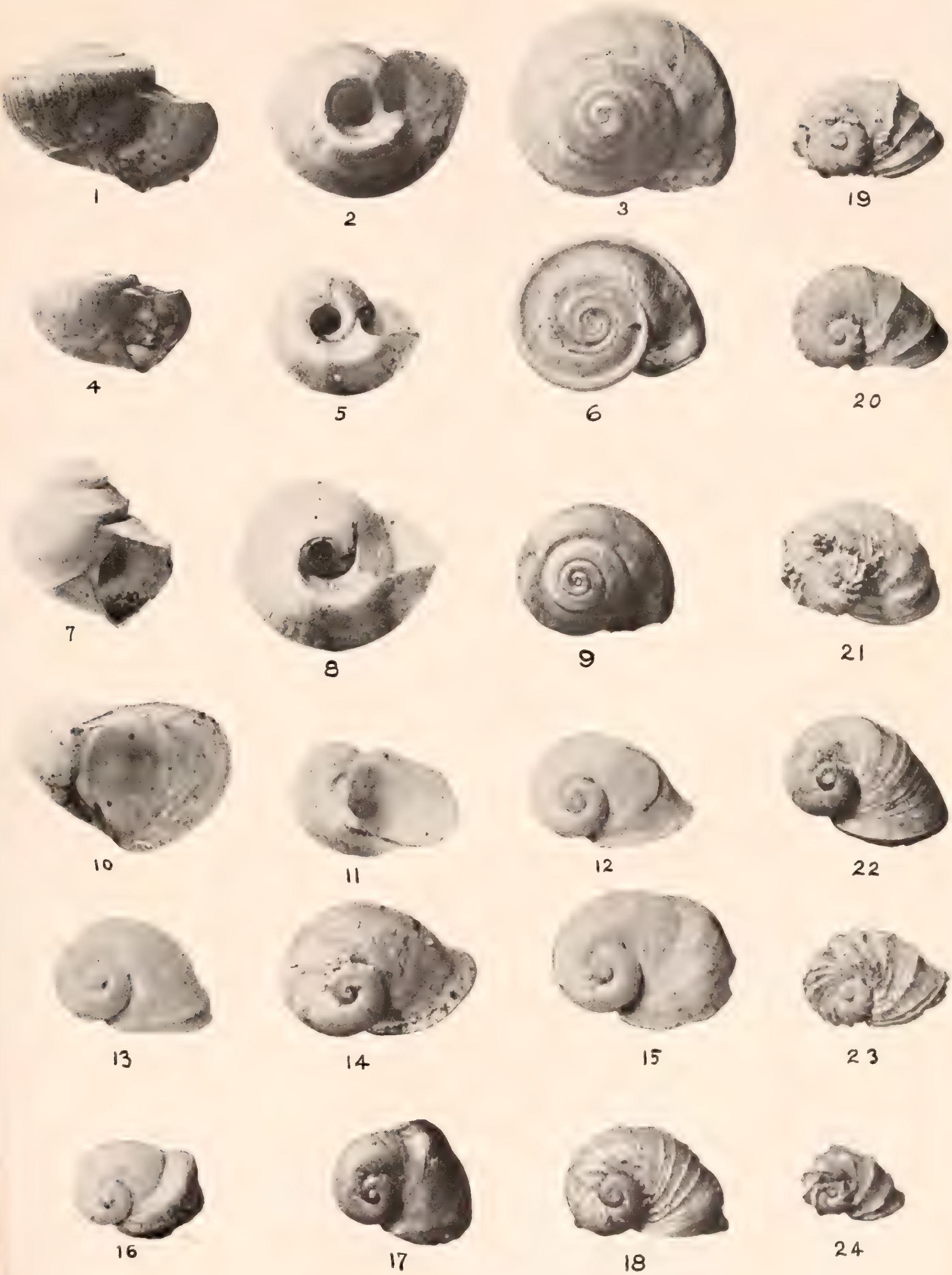

Fig. 1. *Carinifex occidentalis,* type.
Figs. 2-9. *Carinifex occidentalis,* paratypes.
Fig. 10. *Parapholyx mailliardi,* type.
Figs. 11-24. *Parapholyx mailliardi,* paratypes.

All figures enlarged 2.3 diameters.

BIOLOGICAL LABORATORY

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VIII

NOTES ON SOME ECHINOIDS FROM THE SAN RAFAEL AND TUXPAM BEDS OF THE TAMPICO REGION, MEXICO

BY

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In 1917 Dickerson and Kew published a paper entitled "The Fauna of a Medial Tertiary Formation and the Associated Horizons of Northeastern Mexico."[1] In that paper Kew described four species as new, and listed seven others as previously described species.

In his paper on the "Fossil Echini of the West Indies"[2] Robert Tracy Jackson questioned the specific determination of a number of the Echinoidea figured in the above paper by Kew. The present short paper is the result of a study initiated by reason of Jackson's note.

The geologic occurrence of the various species mentioned in the paper by Dickerson and Kew was given as "Upper Oligocene or Miocene." Since that time E. T. Dumble has given us a paper on "The Geology of the Northern End of the Tampico Embayment Area."[3] In a footnote (p. 156)

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[1] Proc. Calif. Acad. Sci., (4), Vol. 7, No. 5, 1917.

[2] Carnegie Institution of Washington Publ. 306, 1922, footnote on p. 98.

[3] Proc. Calif. Acad. Sci., (4), Vol. 8, No. 4, 1918.

Dumble stated: "The nummulitic limestones of the San Rafael beds are ample warrant for their reference to the Oligocene. The Tuxpam beds were included in the Oligocene because of the identity of certain ferns. Some of these ferns, however, seem to indicate a later horizon and closer collecting may necessitate a reference of the Tuxpam beds to the Miocene."

1. **Cidaris cf. loveni** Cotteau*

Cidaris cf. loveni COTTEAU, KEW, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, in check-list op. p. 128.

The specimen listed by Kew is not available for study at this writing.

Horizon: San Rafael Beds.

* For complete references to Cotteau's species, see Jackson, op. cit.

2. **Clypeaster pileus** Israelsky, new species

Plate 2, fig. 2; plate 3, fig. 2

Clypeaster cubensis COTTEAU, KEW, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, p. 132, pl. 20, fig. 1; pl. 21, fig. 1.

Not *Clypeaster cubensis* COTTEAU, Kongl. Sven. Vet. Akad. Handl., Vol. 13, No. 6, 1875, p. 6, fig'd. in Bol. Com. Mapa Geol. Espana, Vol. 22, 1897, p. 33, pl. 6, figs. 1 to 5.

Test large, more pointed before than behind, length greater than width, abactinally flat from the ambitus to the extremities of the petals, then gently domed to apex; apical system central; petals well formed, broad, nearly closing distally, the odd anterior petal but slightly longer than the posterior pair, the anterior pair the shortest. Greatest width nearly the same in all petals; at place of greatest width the interporiferous area is about twice as wide as each poriferous area. Actinal surface flat except for depression around peristome; periproct round, placed a distance slightly more than its diameter from posterior margin. Tubercles over whole of test. Length, 148 mm.; width, 131 mm.; height, 26.5 mm.

Type: No. 370, Mus. Calif. Acad. Sci., collected by E. T. Dumble and W. F. Sands from **Tuxpam Beds, Tampico Region, Mexico.**

In his footnote Jackson remarked that the specimen called *Clypeaster cubensis* by Kew "appears to be too flattened above the border and has petals too short proportionately to be referred to that species." To this may be added the fact that Cotteau's description calls for a markedly depressed actinal surface while the specimen at hand has a surface which is quite flat except near the peristome.

3. **Clypeaster sanrafælensis** Israelsky, new species

Plate 2, figs. 1a, 1b

Clypeaster concavus COTTEAU, KEW, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, pl. 21, fig. 3; pl. 22, fig. 2.

Not *Clypeaster concavus* COTTEAU, Kongl. Sven. Vet. Akad. Handl., Vol. 13, No. 6, 1875, p. 16, pl. 2, figs. 4 to 8.

Test small, outline subpentagonal, more attenuated before than behind; ambitus well rounded, upper surface rising gently from ambitus to edge of petals, then more abruptly to apex. Actinal surface gently depressed from margin to peristome; periproct elliptical, transverse diameter the greater, placed a distance slightly greater than its anteroposterior diameter from the posterior margin; apical system central, five genital pores; ambulacra petaloid, petals elongate, of nearly equal length, widest about one-half distance from apex to nearly closed extremities; inner pores round, outer slightly elongate; tubercles numerous over whole of test. Length, 50.2 mm.; width, 45.7 mm.; height, 11.6 mm.

Type: No. 372, Mus. Calif. Acad. Sci., collected by Cummins and Sands from **San Rafael Beds, Tampico Region, Mexico.**

Clypeaster sanrafælensis closely resembles *Clypeaster rogersi* Morton (as figured by Clark & Twitchell[4]) in profile, but in outline the new species is more pointed anteriorly. *Clypeaster concavus* Cotteau is much more concave and thicker marginally than is *Clypeaster sanrafælensis,* n. sp.

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[4] U. S. Geol. Surv. Mon. 54, 1915, p. 136, pl. 64, figs. 2a, 2b, 2c, 2d, 3a, 3b, 3c, 3d.

4. **Clypeaster,** sp.

Clypeaster, sp. A, KEW, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, pl. 23, fig. 2; pl. 24, fig. 2.

Fig'd. spec. No. 373, Mus. Calif. Acad. Sci. Horizon: San Rafael Beds.

5. **Scutella cazonensis** Kew

Scutella cazonensis KEW, Proc. Calif. Acad. Sci. (4), Vol. 7, 1917, p. 132, pl. 19, fig. 1.

Type: No. 369, Mus. Calif. Acad. Sci. Horizon: Tuxpam Beds.

6. **Paraster tampicoensis** Israelsky, new species

Schizaster clevei COTTEAU, KEW, Proc. Calif. Acad. Sci. (4) Vol. 7, No. 5, 1917, pl. 18, figs. 1a, 1b, 1c.

Not *Schizaster clevei* COTTEAU, Kongl. Sven. Vet. Akad. Handl., Vol. 13, No. 6, 1875, p. 29, pl. 5, figs. 7, 8,

Test of medium size; outline from above ovoid with notch anteriorly; apical system to rear of center; anterior ambulacrum nonpetaloid, deeply sunken on upper surface in a groove which diminishes in depth as the peristome is approached, the interambulacra forming slight ridges on sides of groove; paired petals deeply excavated; anterior pair the longer, slightly flexuous, interporiferous area about equal in width to each poriferous area; posterior pair short, about one-half length of anterior pair, rounded at extremities, interporiferous area equal in width to each poriferous area; posterior interambulacrum ridged; actinal surface gently rounded, peristome semi-lunar, labiate; primary tubercles larger on actinal than on abactinal surface, but rare on ambulacra; granules over whole of test; peripetalous fasciole sinuous, jointed to lateral fasciole near extremities of anterior paired petals. Length, 47.8 mm.; width, 43 mm.; height, 25.5 mm.

Type: No. 367, Mus. Calif. Acad. Sci., collected by W. F. Cummins from **San Rafael Beds, Tampico Region, Mexico.**

Paraster tampicoensis, n. sp., differs from *Paraster clevei* (Cotteau) in having lesser relative height and shorter posterior petals. Although the apical system is missing in our specimen the new species is tentatively placed in *Paraster* because of its close resemblance to *Paraster clevei* and other forms belonging to that genus.

7. **Schizaster dumblei** Israelsky, new species

Schizaster scherzeri Gabb, Kew, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, pl. 18, fig. 2; pl. 201, fig. 2.

Not *Schizaster scherzeri* Gabb, Journ. Phila. Acad. Nat. Sci., Vol. 8, 1874-81, p. 348, pl. 45, figs. 28, 28a, 28b.

Test of medium size; outline from above ovoid with notch anteriorly, apical system posterior to center; viewed in profile the specimen shows a well-rounded ambitus except where truncated posteriorly; test highest in the posterior interambulacrum; odd anterior ambulacrum deeply sunken, reaching two-thirds of the distance to ambitus from the apical system; greatest width nearly one-third of length; posterior paired petals deeply depressed, only one-half length of anterior; greatest width one-half length; pores of paired petals slit-like; posterior interambulacrum ridge-like between the posterior petals; actinal surface gently rounded; peristome near anterior margin, semi-lunar, labiate. Tubercles over whole of test, primaries largest on actinal side; on plastron tubercles diminish rapidly in size from anterior to posterior portion; peripetalous and lateral fascioles present, but not well preserved. Length, 52 mm.; width, 44 mm.; height, 37 mm.

Named after Professor E. T. Dumble in recognition of his contributions to the geological knowledge of this region.

Type: No. 368, Mus. Calif. Acad. Sci., collected by E. T. Dumble and W. F. Cummins from **San Rafael Beds, Tampico Region, Mexico.**

The petals of *Schizaster dumblei,* n. sp., are relatively shorter than those of *Schizaster scherzei* Gabb, the posterior extremity is broader and the periproct is higher in the steeper posterior truncation.

8. **Agassizia regia** Israelsky, new species

Agassizia clevei Cotteau, Kew, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, pl. 7, figs. 1a, 1b.

Not *Agassizia clevei* Cotteau, Kongl. Sven. Vet. Akad. Handl., Vol. 13, No. 6, 1875, p. 33, pl. 6, figs. 2 to 10.

Species of small size, ovoid, more rounded anteriorly than posteriorly; gently arched anteriorly from ambitus to apex; greatest height through apical system, the latter excentric posteriorly and containing four genital pores; anterior ambulacrum non-petaloid in slight furrow; anterior paired petals divergent, shallowly depressed with the anterior pair of pore rows atrophied as is characteristic of the genus; posterior paired petals short, more depressed than is the anterior pair, width about one-third length; plastron strongly elevated, ornamented with closely spaced scaly tubercles; peristome near anterior border, semi-lunar, labiate posteriorly; periproct in the posterior face; marginal fasciole passes from below the periproct up to point of juncture with peripetalous fasciole, then downward anteriorly to below ambitus in anterior ambulacrum; peripetalous fasciole sinuous, not clearly defined in type; small primary tubercles and intercalated granules over whole of dorsal surface of test. Length, 29.4 mm.; width, 26.5 mm.; height, 22.4 mm.

Type: No. 363, Mus. Calif. Acad. Sci., from **Tuxpam Beds, Tampico Region, Mexico.**

As Jackson (op. cit.) has suggested, this form is closely related to *Agassizia elevata* Jackson. It is, however, different in that it is both higher and broader in relation to its length than is *Agassizia elevata.* The lateral fasciole is much steeper in *Agassizia regia* than in *Agassizia clevei* Cotteau.

9. **Brissopatagus mexicanus** (Kew)

Macropneustes mexicanus Kew, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, p. 134, pl. 24, fig. 3; pl. 25, figs. 1a, 1b.

Type: No. 375, Mus. Calif. Acad. Sci., from **San Rafael Beds.**

Kew remarked that "This species may be distinguished from other forms of *Macropneustes* by the curving of the petals." This character is one belonging to the genus *Brissopatagus* Cotteau.

Brissopatagus mexicanus (Kew) resembles *Eupatagus* (*Brissopotagus*) *beyrichi* Dames[5] in the form of the petals and ornamentation. It differs from Dames' species in its larger size, its less attenuated posterior extremity and in minute details.

10. **Macropneustes dubius** Israelsky, new species

Plate 3, fig. 1.

Macropneustes antillarum Cotteau, Kew, Proc. Calif Acad. Sci. (4), Vol. 7, No. 5, 1917, pl. 24, fig. 1; pl. 26, figs. 1a, 1b.

Not *Peripneustes antillarum* Cotteau, Kongl. Sven. Vet. Akad. Handl., Vol. 13, No. 6, 1875, p. 39, pl. 7, figs. 1 to 3.

Test large, somewhat cordiform, notched anteriorly, truncated posteriorly; ambitus well rounded; apical system well forward of center of test, contains four genital pores; all ambulacra deeply depressed, anterior non-petaloid and with simple pores; paired ambulacra petaloid, poriferous areas wider than interporiferous; anterior petals slightly flexuous, posterior nearly straight; actinal surface nearly flat; peristome near anterior margin, semi-lunar, labiate; periproct near top of posterior truncation; primary tubercles crenulate, perforate, limited abactinally to the area circumscribed by peripetalous fasciole except on borders of anterior furrow; common on interambulacra actinally; smaller tubercles over whole of test; peripetalous fasciole sinuous, re-entrant in the interradia; subanal fasciole questionable. Length, 88 mm.; width, 75 mm.; height, 46 mm.

Type: No. 374, Mus. Calif. Acad. Sci., from **Tuxpam Beds, Tampico Region, Mexico.**

The new species is much higher proportionately than is *Peripneustes antillarum* Cotteau.[6]

Jackson (op. cit., p. 86) remarked regarding *Macropneustes antillarum* (Cotteau): "This species is distinct from others known in the genus in its great size, its elongate form, elevated anteriorly, and strongly inclined posteriorly, its wide and deep anterior furrow, its paired ambulacral petals very long and deep, its small tubercles and very sinuous peripetalous fasciole." It would seem that in so far as this to some extent applies also to *M. clevei* Cotteau and *M. dubius*, n. sp., that this group should be removed from *Macropneustes.*

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[5] Paleontographica Bd. 25, 1887, p. 82, pl. 11, fig. 2.

[6] Kongl. Sven. Vet. Akad. Handl., Vol. 13, No. 6, 1875, p. 38, pl. 7, figs. 1 to 3.

The type species of *Macropneustes, M. deshayesi* Agassiz, has a rather simple peripetalous fasciole and the petals are but gently depressed.

Why Cotteau should have followed the lead of Duncan and have refuted his seemingly valid genus *Peripneustes* instead of redefining it with the above noted characters as a basis is rather puzzling to the writer.

11. **Plagiobrissus cumminsi** (Kew)

Metalia cumminsi KEW, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, p. 133, pl. 21, fig. 2; pl. 23, fig. 1.

Type: No. 371, Mus. Calif. Acad. Sci., from **Tuxpam Beds.**

Since Kew described this species, H. L. Clark has, as stated by Jackson (op. cit. p. 83) revived the generic name *Plagiobrissus* Pomel for those species placed in *Plagionotus* L. Agassiz, the latter name being preoccupied. A. Agassiz in his Revision of the Echini merged this genus with *Metalia* Gray, a very closely allied group.

12. **Paleopneustes elevatus** Israelsky, new species

Plate 4, figs. 1a, 1b

Eupatagus, sp. KEW, Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, check-list op. p. 128.

Test large; outline from above ovoid; in profile the anterior slope much steeper than the posterior; ambitus well rounded; apical system forward of center; four genital pores; odd anterior ambulacrum non-petaloid, flush with surface of test; anterior paired ambulacra sub-petaloid, flush, reaching nearly to ambitus, very divergent; outer pores longer than the inner; interporiferous area broader than each poriferous area at end of petals; posterior petals slightly longer than anterior, otherwise similar; primary tubercles numerous over whole of upper surface of test, scrobiculate and perforate; secondary and tertiary tubercles also present; underside of test largely missing; marginal fasciole not seen on specimen but as the ambital region is rather worn one may well have been present. Length, 128 mm.; width, 115 mm.; height, approx. 70 mm.

Type: No. 1649, Mus. Calif. Acad. Sci., from **San Rafael Beds, Tampico Region, Mexico**; collector not known.

This species is doubtfully placed in *Paleopneustes* Ag. It at least seemingly belongs to the family *Paleopneustidæ,* the genera of which are at the present time not clearly understood.

In size the tubercles resemble those found in *Paleopneustes spectabilis* Meijere.[7]

13. **Lovenia dumblei** Kew

Proc. Calif. Acad. Sci. (4), Vol. 7, No. 5, 1917, p. 136, pl. 17, figs. 2a to 2c.

Type: No. 364, Calif. Acad. Sci. Horizon: Tuxpam Beds.

In this beautiful species the scrobicules are not reflected internally by "pursing." This character would place the species with that group termed *Sarsella* Pomel, which is variously considered as a genus or subgenus by different authors of note.

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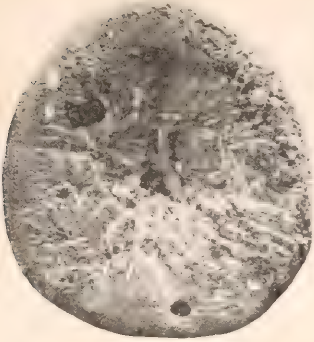
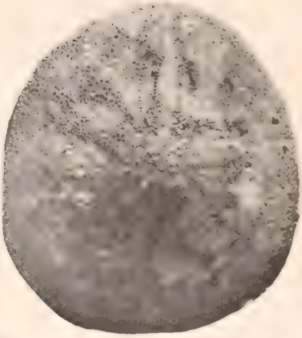
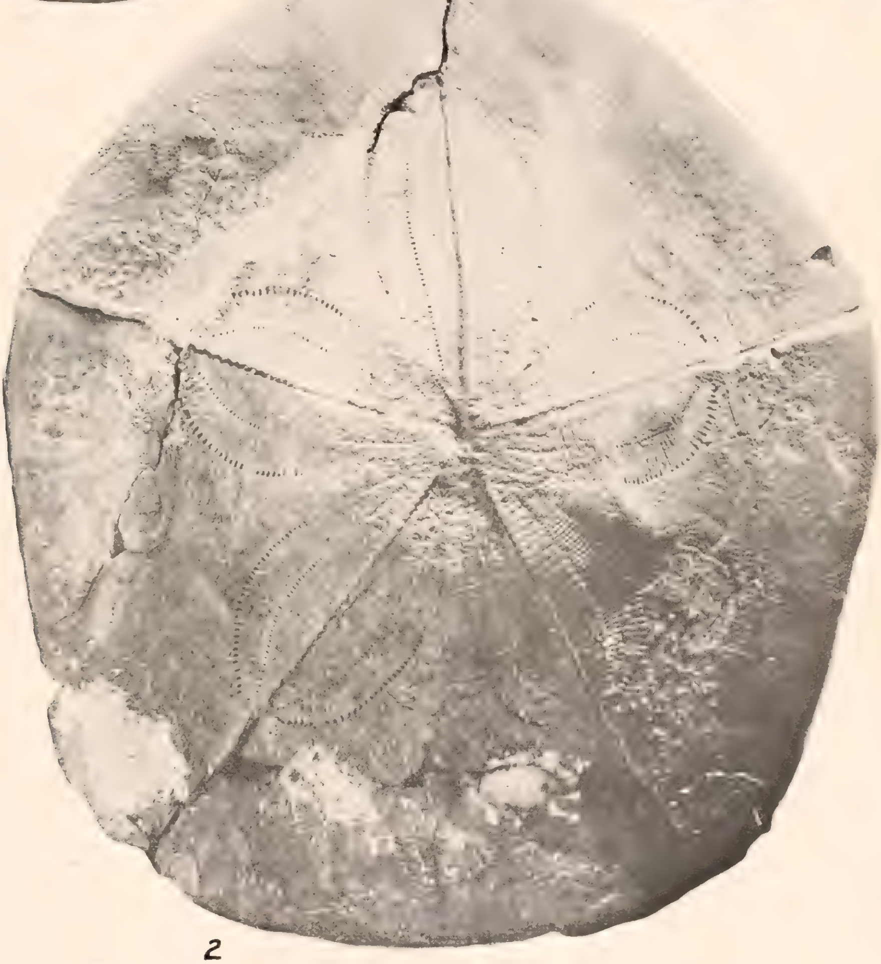
[7] Siboga-Expeditie, Vol. 43, 1904, p. 172, pl. 8, figs. 86 to 90.

1a



1b





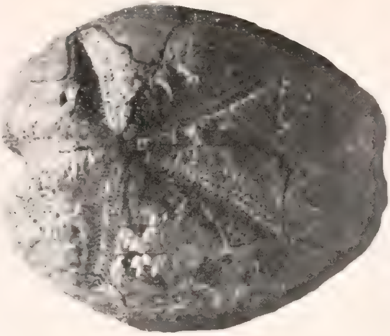
2

Fig. 1a. *Clypeaster sanrafælensis* Israelsky, new species; type No. 372 (C. A. S. Type Coll.), from San Rafael Beds, Tampico Region, Mexico. Oral view.

Fig. 1b. Same. Aboral view.

Fig. 2. *Clypeaster pileus* Israelsky, new species; type No. 370 (C. A. S. Type Coll.), from Tuxpam Beds, Tampico Region, Mexico. Aboral view.

Figures .90 natural size.



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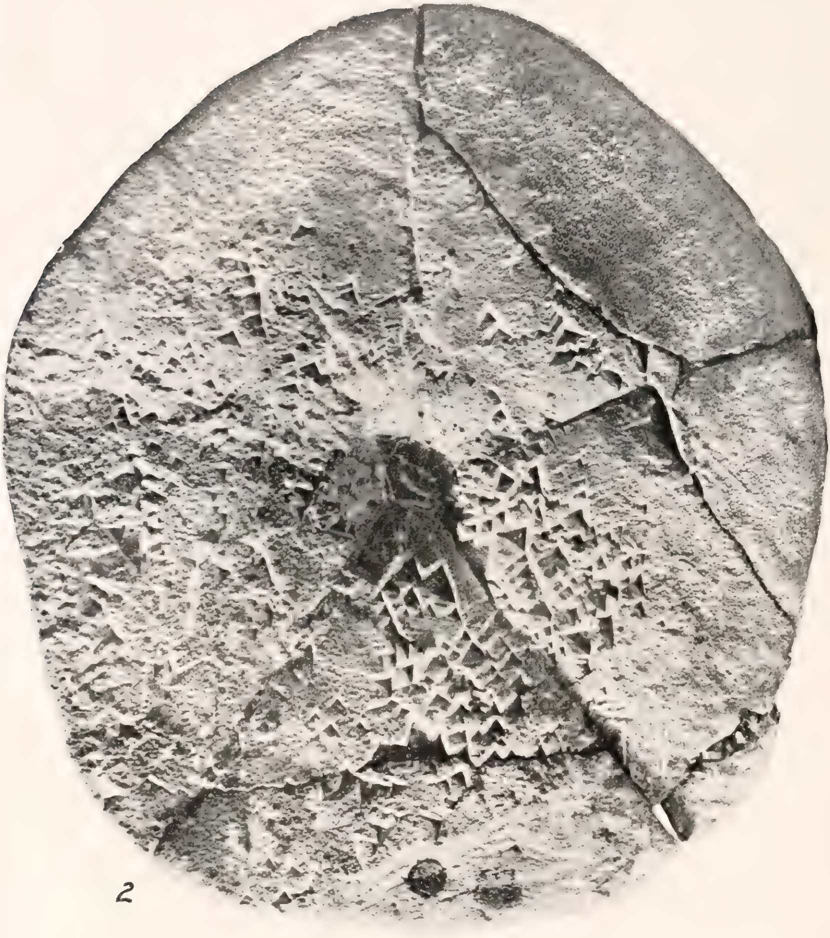
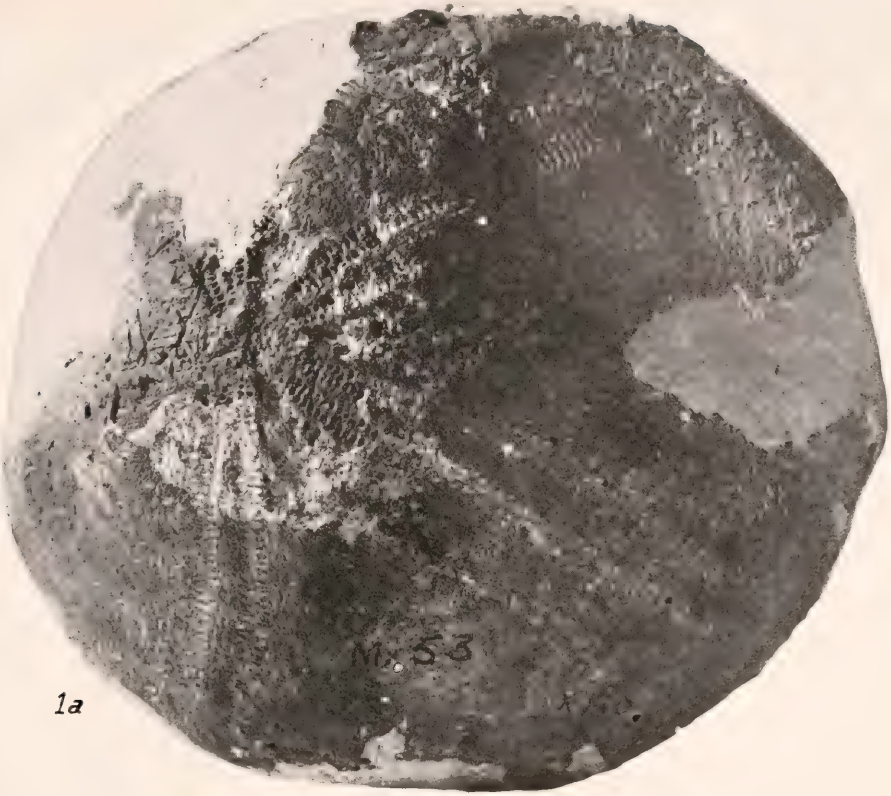


2

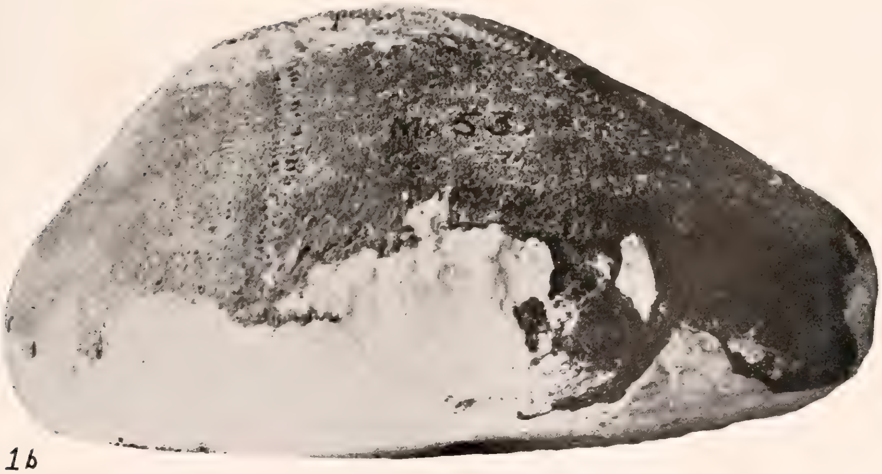
Fig. 1. *Macropneustes dubius* Israelsky, new species; type 374 (C. A. S. Type Coll.), from Tuxpam Beds, Tampico Region, Mexico. Aboral view showing course of peripetalous fasciole.

Fig. 2. *Clypeaster pileus* Israelsky, new species; type No. 370 (C. A. S. Type Coll.), from Tuxpam Beds, Tapico Region, Mexico. Oral view.

Figures .83 natural size.



1a



1b

Fig. 1a. *Paleopneustes elevatus* Israelsky, new species; type No. 1649 (C. A. S. Type Coll.), from San Rafael Beds, Tampico Region, Mexico. Aboral view.

Fig. 1b. Same. Side view.

Figures .81 natural size.

PROCEEDINGS
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IX

DESCRIPTION OF A NEW GENUS AND SPECIES OF FRESHWATER GASTROPOD MOLLUSK *(Scalez petrolia)* FROM THE ETCHEGOIN PLIOCENE OF CALIFORNIA

BY

G. D. HANNA AND E. G. GAYLORD

The investigation of oil-bearing and related sediments of the San Joaquin Valley has resulted in the discovery of the organism described herewith.

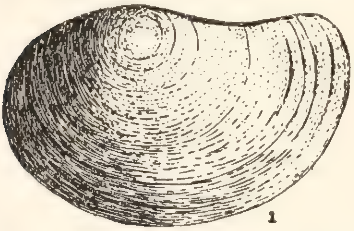
Scalez petrolia, new genus and species

Shell calcareous, thin, flattened, ovate, somewhat more pointed at one end, broadly rounded at the other; dorsal posterior slope broadly concave; non-spiral, concentric, nucleus (apex) placed a short distance beneath dorsal margin but almost in center, longitudinally; outer side (Fig. 1) concave, marked with rough, irregular lamellar growth-ridges which are most pronounced near ventral margin; inner side (Fig. 2) convex, smooth, covered with a deposit of testaceous material; near the ventral margin is a depressed groove on the inner side corresponding in position to a simple pallial line of some lamellibranch molusks; dorsal margin, inside marked by a rounded ridge. Length of type, 7.6 mm.; width, 5.3 mm.

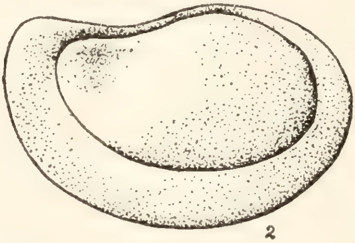
Type: No. 1696, Mus. Calif. Acad. Sci., from Midlands Oil Company's well No. 1 in the S. W. corner of Sec. 34, T. 32 S., R. 24 E., M. D. M., at a depth of 3306 feet.

Paratypes: Nos. 1697 and 1698, Mus. Calif. Acad. Sci., from Pacific Oil Company's well No. 23, Sec. 35, T. 30 S., R. 24 E., M. D. M., at a depth of 3000 feet.

This organism has been found widely distributed in western Kern County, California, in the Sunset-Midway oil field. The specimens thus far have been obtained only from one thin layer of mud-shale which lies beneath the uppermost marine member of the Etchegoin Pliocene. This last is in turn overlaid with freshwater and alluvial deposits classed as the Paso Robles (Tulare) Formation. The shells are very abundant in the particular layer where they occur and such characteristically freshwater genera as Anodonta and Amnicola have been found with them at times. They have only been found in cores obtained from oil wells drilled in the region and have not been detected, thus far, in a surface outcrop.



1



2

Fig. 1. ***Scalez petrolia,*** **external, concave side, X 6.**
Fig. 2. ***Scalez petrolia,*** **internal, convex side, X 6.**

At first glance these flattened plates appear to be the shells of bivalve mollusks, or crustaceans, or even the scales of fishes, but they either lack or possess characters which definitely exclude them from those groups. The nucleus or apex is not at the margin as usual in bivalve mollusks and crustaceans; the concave side faces the exterior and bears lines of growth; the inner surface has no muscle-scars and what would be the hinge line if they were shells of bivalves, shows no evidence of teeth or a true hinge. The fossils have no overlapping areas such as are usually found on scales of fishes; they show no evidence of having been fitted together to form an armor such as may be seen among the ganoids.

The best evidence to show that the shells are of gastropod origin lies in the fact that all which have been examined are asymmetrical the same way. This could not be true if they belonged to any of the other groups mentioned. They appear to be the operculums of freshwater gastropods belonging in or near the family Amnicolidæ and the subfamily Bythininæ, as recently defined by Walker,[1] but the animals either did not possess shells, or if they did, they must have been composed of chitonous or other material which was not preserved in the sediments. Among the large number of specimens examined no trace of a spiral shell such as these would fit has been seen. It would seemingly be impossible for operculums to accumulate in a single layer over so large an area and leave no trace of the shells they closed. At the present time no freshwater naked or chitonous-shelled mollusk is known which is closely related to the above-mentioned family, but it is not inconceivable that one may have existed during the closing days of the Etchegoin Sea. The same body of water contained many other remarkable organisms.

The genus-name Scalez was not obtained from any linguistic or other source, but was chosen because of the general resemblance of the shells to fish scales under which name they were known for some time. The species-name was chosen because of the value the organisms have as an indicator of petroleum-bearing strata.

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[1] **Univ. Michigan Misc. Publ. No. 6, 1918, p. 27.**

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MARINE BIOLOGICAL LABORATORY

X

RECTIFICATIONS OF NOMENCLATURE

BY

G. DALLAS HANNA

Curator, Department of Invertebrate Paleontology

During the winter of 1922-1923 Mr. Frank M. Anderson and the writer spent much time and labor in an endeavor to monograph the fauna of the Eocene at the type locality of the Tejon group in Kern County, California. In the course of the work several names of West American fossils were found to be preoccupied in geological literature and require replacing to accord with the rules of the International Commission of Zoological Nomenclature. To bring these to the notice of workers it was thought best to incorporate them in a separate paper, thinking they would be less likely to be overlooked than if they were scattered in publications dealing with various particular problems.

Before making a record of the few names thus found it was thought advisable to spend a short time in an examination of literature for the purpose of ascertaining if any other such instances needed attention. Accordingly, several days were spent in the libraries of the California Academy of Sciences and the University of California with the results set forth below.

Indeed, so many names requiring replacement were found that I almost decided to abandon the project and leave the disagreeable task of making corrections to others who might derive greater satisfaction therefrom. But my co-workers on the Pacific Coast have urged the publication of the document in order to keep the revisions in an accessible western publication rather than to have them scattered through the great mass of zoological literature as they might be discovered. It is regretted that the changes cannot be published anonymously.

During the last ten years a great deal of activity has been shown in western geology and paleontology and a study of the huge collections which have been assembled has made necessary the description of a great many new species. It is practically impossible for a student to be certain, when he adopts a new name, that it has not already been used for another species somewhere in the world. He can examine only a very small fraction of the total literature of his subject. For this reason, criticism of past efforts will be omitted. I shall merely point out a few sources of error, and incidentally refer to some standard books which may be useful to future workers before they publish their new names. If these be searched for the names they propose to introduce it is possible that they may discover that some have already been used.

Many thousands of species of living and fossil mollusks have been described in the past, and this very fact makes it unsafe to use any of the ordinary Latin descriptive terms for names. This is particularly true in the large genera such as Pecten, Cardium, Pleurotoma, etc. It is equally dangerous to use hackneyed proper names, either geographical or personal. The names of some states have been used over and over in literature and the same is true of some of our most celebrated paleontologists and conchologists. Also, it should be remembered that modern active workers are not always the only ones with the same surname who have been engaged in similar studies. Much as we may wish to perpetuate the names of university teachers of geology and others whom we admire, we should remember that in some noteworthy cases there have been other beloved men in similar work elsewhere and their names have been given to species which are widely scattered in the literature.

There are still many new species of invertebrate fossils in western collections to be described, and probably a larger number in the field awaiting the explorer. It is hoped that the following pages will not discourage any worker who may take up the problems of monographing the exceedingly rich faunas of the western states. But before new names are published it is suggested that at least some time be given to a search to ascertain if they be valid. As many of the following works should be examined as possible, and if time permits, the student will do well to go farther afield. He should always remember that irrespective of the amount of time thus given he can never be certain that his names are actually new.

The geological publications of the western institutions should, of course, be examined. These include the Proceedings and Memoirs of the California Academy of Sciences, the University of California Publications in Geology, and the University of Washington Publications in Geology. Other standard works of reference are:

Reeve, Conchologica Iconica
Sowerby, Conchological Illustrations
Sowerby, Mineral Conchology of Great Britain
Sowerby, Theasaurus Conchyliorum
Martini and Chemnitz, Conchylogical Cabinet
Tryon, Manual of Conchology
d'Orbigny, Prodrome de Paleontology
Bronn, Index Paleontologicus
Sherborn, Index Animalium
Dall, Tertiary Fauna of Florida
Gabb, Paleontology of California

These works contain or in themselves are indices, so that the search for names can be made with some rapidity. The great work of Sherborn is most valuable in this connection and gives a concrete picture of the enormity of zoological literature. The first volume takes the subject from 1758 to

1800 and succeeding volumes will complete it to 1850, but at the date of writing only the index as far as the name *affinis* has been published.[1]

As a final search, if time permits, the student should examine the section on Mollusca (or other subject concerned) which has appeared each year in the Zoological Record since 1864. Most of the new species described are mentioned in these invaluable volumes.

There is little need for repetition of generic names. Scudder's Nomenclator Zoologicus lists practically all that appeared up to 1880. From 1880 to 1900 and from 1901 to 1910 the Zoological Record management has issued two volumes of "Index Zoologicus." Since 1910 the new names may be found at the end of each annual volume of the Zoological Record.

In making the following corrections and emendations I wish for the present to refrain from subscribing fully to the rules which make them necessary. Chief among these is the law of priority which prevents the use of the same name for two different species in the animal kingdom. It was expected that this rule would stabilize nomenclature, but it may be asked if the opposite has not been the real effect. In fact, it may be questioned if an attempt to change a well-established name does not actually produce more confusion than if it had been left alone. Most certainly it has this effect upon beginners in zoological classification. But, although the law of priority unquestionably has produced profound confusion in literature, it is generally accepted throughout the world. Through a long-continued process of sifting it may eventually produce a stabilized nomenclature, but it also seems likely that it will wreck our present scheme of classification completely.

It is customary when a writer discovers a homonym to rename the last-named species. Often this is done in his own contribution which may be upon a distinctly unrelated subject. Many times it has been done in a brief foot-note, in a check-list, or as a short contribution to a scientific journal. In a great many cases the correction entirely escapes the notice of the workers in the field concerned because of its very obscurity. For these reasons it seems desirable to correct the names of West American species in a publication in the region concerned.

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[1] Part 2, extending the index to *anus* has since appeared.

In a few cases it has been found that species elsewhere have been given the same names which had previously been used for western forms. These are renamed herein simply because it is current practice, or because the species in question is of interest to western students.

Attention is called herein to the names of some species which may or may not require replacement, in the hope that future students may take cognizance of them and determine the needs of the particular cases. In some families of mollusks the generic nomenclature is so unstable that it is not possible in the time available to determine if a western species belongs to the same genus as another elsewhere which bears the same specific name; sometimes they may and again they may not. I do not wish to add to the confusion unless it be necessary.

On account of the bibliographical difficulties involved it is not good practice to use a name which differs by only one or two letters from an established one. A few examples of such usage are cited.

The original authors of the specific names which are preoccupied have been communicated with when possible without too great delay and I am therefore able to present new names by them. I only regret that it was not possible to do this in every case. Greatest appreciation is extended to Mr. Frank M. Anderson for aid in preparation of the list.

1. **Acila nehalemensis** Hanna, new name

Nucula (*Acila*) *cordata* Dall Trans. Wagner Free Inst. Sci., Vol. 3, pt. 4, 1898, p. 573, pl. 40, fig. 4, Miocene, Nehalem River, near Mist, Columbia County, Oregon.

Not *Nucula cordata* Goldfuss, Petref. Vol. 2, 1838, p. 155. pl. 125, fig. 6, France.

Not *Nucula* (*Nuculoidea*) *cordata* Williams & Berger, U. S. Geol. Surv. Prof. Pap. 89, 1916, p. 175, pl. 19, fig. 6, Devonian, Maine.

The Oregon species, unfortunately, requires a different name.

Although Nuculoidea was described as a subgenus under Nucula, it was used as a genus where the actual description appears. The group seems to be distinct generically from Nucula, and the specific name might therefore be allowed to stand. A ruling by the committee on nomenclature of the International Commission would be advisable in this case.

2. **Acmæa ocitatia** Hanna, new name

Patella subquadrata Dickerson, Proc. Calif. Acad. Sci., 4th Ser., Vol. 7, 1917, p. 182, pl. 31, figs. 13a, 13b, Oligocene near Vader, Lewis County, Washington.

Not *Patella subquadrata* Dunker, Palæontographica, No. 1, 1847, p. 113 pl. 13, fig. 18.

The last cited species was renamed *dunkeri* by d'Orbigny because of a prior *P. subquadrata* of York but the reference need not be completed as it is obvious that Dickerson's name cannot be adopted in accordance with the present system of nomenclature.

3. **Acanthoceras turneri** (White)

Ammonites turneri White, Bull. U. S. Geol. Surv., No. 51, 1889, p. 26, pl. 5, figs. 1, 2, Chico Cretaceous, Curry's Canada, south of Mt. Diablo, California;="Acanthoceras." F. M. A.

Not *Ammonites turneri* Sowerby, Mineral Conchology, Vol. 5, 1825, p. 75, pl. 452; = "Schloenbachia." F. M. A.

A rigid interpretation of the rules would require that the California fossil be renamed. But Mr. F. M. Anderson is of the opinion that this should not be done since Ammonites in its original broad sense is obsolete as a generic name and the two species obviously belong to different genera.

4. **Antiplanes rotula** Dall[1]

Antiplanes rotula Dall, U. S. Nat. Mus. Bull. 112, 1921, pp. 71, 200; new name for *Pleurotoma smithi* Arnold, not Forbes.

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[1] The date "1919" which appears after the name *"rotula"* on p. 71 of Bull. 112, U. S. Nat Mus., is evidently an error due to delayed publication. I have been informed by Dr. Fred Baker, Point Loma, California, that there are several such unavoidable discrepancies in the paper. Such may easily happen when a paper is held in press for a period of years.

Pleurotoma (*Spirotropis*) *smithi* ARNOLD, Mem. Calif. Acad. Sci., Vol. 3, 1903, p. 216, pl. 6, fig. 13, Pliocene, Deadman Island, Los Angeles County, California.

Not *Pleurotoma trevelyana smithii* JEFFREYS, Ann. Mag. Nat. Hist. 1876, p. 332.

Not *Pleurotoma smithii* FORBES, Ann. Mag. Nat. Hist. 1840, p. 107, pl. 2, fig. 14.

Tryon has stated[2] that Forbes species is a synonym of *Drillia costulata* Blainville, but a new name was necessary for Arnold's species nevertheless, because it is an exact homonym. It is not known if the subspecies described by Jeffreys is sufficiently distinct to require a new name.

5. **Arca invalida** Hanna, new name

Arca dalli BROWN & PILSBRY, Proc. Nat. Acad. Sci. Phila. 1912, p. 510, pl. 23, fig. 4, [Miocene], Culebra Cut, Isthmus of Panama.

Not *Arca* (*Macrodon*) *dalli* SMITH, Challenger Rept., Vol. 13, 1885, p. 269, pl. 17, figs. 10, 10b, off Kobé, Japan, living.

The importance of the Gatun fauna has become apparent in recent years because it occupies a key position in Atlantic-Pacific correlation. Western paleontologists are making constant use of the various species and large collections are in some of the museums, notably that in the California Academy of Sciences, made by Messrs. F. M. Anderson and Bruce G. Martin. It is therefore necessary to provide a name for the species of Arca previously provided with a homonym.

6. **Astarte ? acerba** Hanna, new name

Astarte ? sulcata PACKARD, Univ. Calif. Publ. Geol. Vol. 13, 1922, p. 424, pl. 33, fig. 6, Cretaceous, Santa Ana Mountains, California.

Not *Astarte sulcata* (DA COSTA), Brit. Conch., 1778, p. 192, a living species.

Not *Astarte sulcata* LEA, 1833 of Claiborn, Eocene, (Vide DALL, Trans. Wag. Free Inst. Sci. Vol. 3, pt. 6, 1903, pp. 1483, 1487, 1490).

In a revision of the family Astartidæ in 1903, Dall[3] gave *Astarte sulcata* (Da Costa) as the type of the genus. It therefore becomes impossible to apply the same name to the California Cretaceous fossil.

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[2] Man. Conch. Vol. 6, p. 374.

[3] Proc. U. S. Nat. Mus., Vol. 26, 1903, p. 936.

7. **Borsonella angelana** Hanna, new name

Pleurotoma (*Borsonia*) *dalli* ARNOLD, Mem. Calif. Acad. Sci., Vol. 3, 1903, p. 201, pl. 6, fig. 2, Lower San Pedro Group, Deadman Island, Los Angeles County, California.

Not *Pleurotoma dalli* VERRILL & SMITH, Trans. Conn. Acad. Sci., Vol. 5, 1882, p. 451, pl. 57, figs. 1, 1a, East Coast North America, living; Tryon, Manual Conch., Vol. 6, p. 181, placed the species in Drillia.

The California fossil described by Arnold became the type of the subgenus Borsonella Dall.[4] A new specific name is required, however, because the one in current use is an exact homonym.

Tryon placed Verrill & Smith's species in "Drillia," which has lately become an abandoned name for West American shells.

8. **Borsonella ? nuncapatia** Hanna, new name

Turris lincolnensis VAN WINKLE, Univ. Wash. Publ. Geol., Vol. 1, No. 2, 1918, p. 92, (pl. 7, fig. 24, is cited but does not appear in the publication), Oligocene near Lincoln Creek Station, Washington.

Not *Turris lincolnensis* ANDERSON & MARTIN, Proc. Calif. Acad. Sci., 4th Ser., Vol. 4, 1914,, p. 88, pl. 6, fig. 8, Miocene of Oregon Coast five miles south of Yaquina Bay, Loc. 36. (C. A. S. Coll.)

Miss Van Winkle did not illustrate her *"Turris lincolnensis,"* but a comparison of the description with Anderson & Martin's type, description and figure shows that different species were being considered. In the absence of a figure or comparison with other species the generic reference must be provisional until these are supplied. From the description alone it might be placed in any one of several groups now given generic standing.

9. **Borsonella polynotata** Hanna, new name

Turris (*Drillia*) *modestus* MOODY, Univ. Calif. Publ. Geol., Vol. 10, 1916, p. 54, pl. 1, fig. 8, Pliocene, Los Angeles, California.

Not *Pleurotoma modesta* SOWERBY, Proc. Zool. Soc. London, 1833, p. 136, which Reeve, (Conch. Icon. Vol. 1, 1843,) considered the same as *P. cincta* Lamarck.

Not *Pleurotoma modesta* WEINKAUFF, Kuster, Conch. Cab., p. 44, pl. 9, fig. 9.

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[4] Bull. 43, Mus. Comp. Zool. Harvard, 1907, p. 258.

Not *Clathurella modesta* Angas, Proc. Zool. Soc. London, 1877, p. 38, pl. 5, fig. 15.

The name selected by Moody for the California Pliocene species is unfortunately not available through prior use of the same specific portion for species, some of which are obviously congeneric.

10. **Bullaria obtenta** Hanna, new name

Bullaria tumida Packard, Univ. Calif. Publ. Geol., Vol. 13, 1922, p. 433, pl. 37, fig. 2, (not fig. 4), Cretaceous of southern California.

Not *Bulla tumida* A. Adams, in Sowerby, Theasaurus Conchyliorum, p. 573, pl. 125, fig. 169.

Since it is generally accepted that Bullaria properly replaces Bulla it is not possible to use the specific name *tumida* as above for the California fossil.

11. **Cancellaria angelana** Hanna, new name

Cancellaria quadrata Moody, Univ. Calif. Publ. Geol., Vol. 10, 1916, p. 56, pl. 1, fig. 6, Pliocene, Los Angeles, California.

Not *Cancellaria quadrata* Sowerby, Mineral Conchology, Vol. 4, 1823, p. 83, pl. 360, Eocene, Barton, England, (see Newton, Cat. Oligocene and Eocene, Brit. Mus., p. 172).

Moody's name is an exact homonym and must be replaced in accordance with the international rules of nomenclature.

12. **Cancellaria siletzensis** Anderson, new name

Cancellaria rotunda Anderson & Martin, Proc. Calif. Acad. Sci., 4th Ser., Vol. 4, 1914, p. 87, pl. 8, figs. 4a, 4b, Miocene, one-half mile north of Yaquina Bay, Oregon.

Not *Cancellaria conradiana rotunda* Dall, Trans. Wagner Free Inst. Sci., Vol. 3, pt. 2, 1892, p. 224, pl. 3, fig. 13 (in pt. 1), Miocene, North Carolina.

As the name of the Oregon species is a homonym and cannot be used, Mr. F. M. Anderson has proposed a substitution as above.

13. **Cancellaria fernandoensis tribulus** Nomland

Cancellaria fernandoensis tribulus Nomland, Univ. Calif. Publ. Geol., Vol. 10, 1917, p. 238, pl. 12, figs. 1, 1a, Etchegoin Pliocene, Middle California.

Not *Voluta tribulus* BROCCHI, Conch. Fossil. Subapennina, 1814, p. 310, pl. 3, fig. 14; Risso, placed this species in *Cancellaria.*

There would seem to be some doubt as to the usefulness of the subspecies *tribulus,* described by Nomland; the material upon which it was based was not well preserved and it may be questionable whether it can be distinguished sufficiently well to be retained as a definitely named form. Attention is called to the matter here because the name chosen would probably have to be abandoned if the species should be retained.

14. **Cancellaria simiana** Hanna, new name

Cancellaria crassa WARING, Proc. Calif. Acad. Sci., 4th Ser., Vol. 7, July 30, 1917, p. 66, pl. 9, fig. 5, Chico Cretaceous, Bell's Canyon, Simi Hills, Los Angeles County, California.

Not *Cancellaria crassa* NOMLAND, Univ. Calif. Publ. Geol., Vol. 10, April 19, 1917, p. 237, pl. 12, figs. 7, 7a, Etchegoin Pliocene, Waltham Creek near Coalinga, California.

Only three months intervened between the appearance of these two species with the same name. Since the Cretaceous form was the later it requires to be renamed.

15. **Cardium gorgasi** Hanna, new name

Cardium (*Lævicardium*) *dalli* TOULA, Jahrbuch der Kaiserlich-Koniglichen Geologichen Reichsanstalt, Vol. 58, 1908, p. 722, Isthmus of Panama, [Miocene].

Not *Cardium dalli* DICKERSON, 1913, see p. —

Not *Cardium dalli* HEILPRIN, Trans. Wagner Free Inst. Sci., Vol. 1, 1887, p. 131, pl. 16a, fig. 70, Pliocene of Florida.

The Gatun species is apparently unfigured,[5] but it does not appear to have been renamed, although it is an exact homonym. Very large Gatun collections are being studied by western paleontologists and the species is therefore renamed here for their use. The specific name is chosen for Surgeon General W. C. Gorgas, whose labors made the cutting of the Panama Canal possible.

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[5] See Brown and Pilsby Proc. Acad. Nat. Sci. Phila., 1911, p. 367.

16. **Cardium marysvillensis** Dickerson

Cardium dalli Dickerson, Univ. Calif. Publ. Geol., Vol. 7, 1913, p. 289, pl. 14, figs. 4a, 4b, 4c, Eocene, Marysville Buttes, Sutter County, California.
Not *Cardium dalli* Toula, 1908, see p. —.
Not *Cardium dalli* Heilprin, Trans. Wagner Free Inst. Sci., Vol. 1, 1887, p. 131, pl, 16a, fig. 70, Pliocene of Florida. — Dall, Trans. Wagner Free Inst. Sci., Vol. 3, pt. 5, 1900, p. 1090.
Cardium marysvillensis Dickerson, Univ. Calif. Publ. Geol., Vol. 9, 1916, p. 482.

Dr. Dickerson discovered that his name "*Cardium dalli*" was a homonym and renamed the species as shown. Attention is called to it here in order to aid in proper specific reference in the future.

17. **Cerithiopsis alternata** Gabb

Cerithiopsis alternata Gabb, Geol. Surv. Calif. Pal., Vol. 1, 1864, p. 116, pl. 21, figs. 114, 114a, Martinez Eocene, California.
Not *Cerithium alternatum* Sowerby, Thes. Conch., Vol. 2, 1855, p. 872, figs. 70, 73, 179, Philippine Islands, living.

There is cause for some doubt as to the reference of Gabb's species to Cerithiopsis; it would seem to be equally well placed in Cerithium and may in fact properly belong there. Attention is called to the earlier name here in hopes that someone who may study the Martinez fauna may be able to determine the matter definitely.

18. **Cerithiopsis preussi** Hanna, new name

Cerithiopsis oregonensis Dickerson, Proc. Calif. Acad. Sci., 4th Ser., Vol. 4, 1914, p. 121, pl. 11, figs. 5a, 5b, Eocene Roseburg Quadrangle, Oregon.
Not *Cerithiopsis ? oregonensis* Conrad, Am. Journ. Conch., Vol. 1, 1865, p. 151; name for figs. 13, 14, pl. 20, Geol. U. S. Exp. Exped. Atlas, 1849.

Conrad's species has been placed in the genus Turritella,[6] but that does not permit the name to be used again as Dickerson proposed because it is an exact homonym.

The new name is in honor of Mr. Charles Preuss, the topographer who accompanied Captain J. C. Fremont on his memorable overland journey to Oregon and California in 1843-1844.

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[6] Dall, Trans. Wagner Free. Inst. Sci., Vol. 3, pt. 2, 1892, p. 271; U. S. Geol. Surv. Prof. Paper 59, 1909, p. 78.

19. **Cerithium ? teslaensis** Hanna, new name

Cerithium branneri Hall & Ambrose, Nautilus, Vol. 30, 1916, p. 20, Middle Cretaceous, Corral Hollow, Tesla Quadrangle, California.

Not *Cerithium branneri* White, Arch. Mus. Nat. Rio de Janeiro, Vol. 8, 1887, p. 153, Brazil.

Unfortunately Hall & Ambrose failed to illustrate their species and it is very difficult to determine the exact generic relationship without an examination of the original specimens. But their name in this case is an exact homonym and must be replaced or discarded altogether. The writer is in favor of taking the latter course with all unillustrated species, but there appears to be no authority to warrant such action at present.

20. **Chama grunskyi** Hanna, new name

Chama pacifica Dickerson, Proc. Calif. Acad. Sci., 4th Ser., Vol. 7, 1917, p. 172, pl. 29, fig. 10, "Oligocene" near Vader, Lewis County, Washington.

Not *Chama pacifica,* Broderip, Proc. Zool. Soc. London, 1834, p. 149, Lord Hood's Island, Pacific Ocean.

The name of the Washington species is an exact homonym and the new one is selected in honor of Mr. C. E. Grunsky, President of the California Academy of Sciences.

21. **Chrysodomus ? prænominata** Hanna, new name

Chrysodomus packardi Nomland, Univ. Calif. Publ. Geol., Vol. 10, 1917, p. 235, pl. 12, figs. 4, 4a, 4b, Etchegoin Pliocene, California.

Not *Chrysodomus packardi* Weaver, Univ. Wash. Publ. Geol., Vol. 1, No. 1, 1916, p. 47, pl. 4, figs. 57, 58, near Lincoln Creek Station, Washington.

The species described by Nomland requires a new name because the one he chose had already been used by Weaver. The proper generic determination of the California species is difficult to ascertain from the figures and description; it is therefore left questionably in Chrysodomus.

Tryon in 1881[7] named some fossil shells from Maine "*Buccinum packardi.*" It it should be shown that the Washington fossil belongs to Buccinum then it would require a new name, although Tryon's species cannot be recognized from his description. Such circumstances as this form one of the most discouraging parts of modern taxonomy.

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[7] Man. Conch., Vol. 3, 1881, p. 185.

22. **Columbella arnoldi** Dall

Columbella (*Anachis*) *arnoldi* Dall, Proc. U. S. Nat. Mus., Vol. 34, 1908, p. 250, new name for

Columbella (*Anachis*) *minima* Arnold, Mem. Calif. Acad. Sci., Vol. 3, 1903, p. 237, pl. 9, fig. 8, Pleistocene, San Pedro, California.

Dr. Dall stated that Arnold's species required a new name because the one given was "several times preoccupied." No citation was given to the literature where one may find an earlier use of the name and in the limited time at my disposal I have failed to find any. Nevertheless, it is quite probable that so common a Latin derivative would have been appropriated long ago.

23. **Corbula binominata** Hanna, new name

Corbula tenuis Moody, Univ. Calif. Publ. Geol., Vol. 10, No. 4, 1916, p. 59, pl. 2, figs. 4a, 4b, Pliocene, Los Angeles, California.

Not *Corbula tenuis* Sowerby, Proc. Zool. Soc. London, 1833, p. 36.

Not *Pachydon tenua* Gabb, Amer. Journ. Conch., Vol. 4, 1868, p. 199, pl. 16, figs. 6, 6a, upper Amazon, South America; Dall (Trans. Wagner Free Inst. Sci. Vol. 3, pt. 4, 1898, p. 840) called Gabb's species "*Corbula* (*Anisothyris*) *tenuis* (Gabb)."

The California Pliocene species requires to be renamed because it is an exact homonym of the species dating from 1833, even though there might be some question as to the Amazon species falling into Corbula where Dall placed it.

24. **Corbula complicata** Hanna, new name

Corbula dilatata Waring, Proc. Calif. Acad. Sci., 4th Ser., Vol. 7, 1917, p. 92, pl. 15, fig. 2, "Tejon" Eocene, McCray Wells, Ventura County, California.

Not *Corbula dilatata* Eichwald, Naturh. Skizze Lithuaen, etc., 1830, p. 205.

The name selected by Waring is an absolute homonym and cannot be used, according to present rules of nomenclature. There is considerable doubt as to whether the horizon from which the fossil came is equivalent to the Eocene at the Type locality of the Tejon Group.

25. **Crassatellites dalli** Weaver

Crassatellites dalli Weaver, Univ. Wash. Publ. Geol., Vol. 1, No. 1, 1916, p. 39, pl. 2, figs. 15-18, upper Eocene of Washington.
Not *Cuna dalli* Vanatta, Proc. Acad. Nat. Sci. Phila., Vol. 55, 1903, p. 759, fig. 3, Indian Pass, West Florida, living.

Maury[8] has placed Vanatta's species from Florida in the genus Crassatellites and considered Cuna as a subgenus, a course previously taken by Dall.[8a] If this action be justified then Weaver's species requires to be renamed. But it does not seem that the minute forms usually referred to Cuna can be included with the large Eocene crassatellids in view of the fine distinctions which are used for generic discrimination of late years. Therefore it seems to me that the Washington *dalli* can be considered a valid name, at least for the present.

26. **Cryptoconus injucundus** Hanna, new name

Drillia cooperi Dickerson, Univ. Calif. Publ. Geol., Vol. 9, 1916, p. 491, pl. 40, figs. 4a, 4b, Eocene, Marysville Buttes, Sutter County, California.
Not *Pleurotoma* (*Dolichotoma*) *cooperi* Arnold, Mem. Calif. Acad. Sci., Vol. 3, 1903, p. 203, pl. 7, fig. 3, upper San Pedro Group, San Pedro, California.

It appears that both of the above species belong to the group of turrids which Dall[9] has recently referred to the genus Cryptoconus and which have variously been called Surcula, Pleurotoma, Bathytoma, etc. This makes necessary the renaming of the Eocene species.

27. **Cymbophora intoxicata** Hanna, new name

Cardium (*Proctocardia*) *linteum* Conrad, Journ. Acad. Nat. Sci. Phila., 2nd Ser., Vol. 4, 1858-1860, p. 278, pl. 46, fig. 17, Tippah County, Mississippi.

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[8] Bulletin 34, Amer. Paleo., 1920, p. 77.

[8a] Trans. Wagner Inst., Vol. 3, pt. 3.

[9] Bull. 112, U. S. Nat. Mus. 1922.

Not *Cardium linteum* Conrad, House Doc. 129, Projected Vol. 3, 33d Congress, first Sess. 1855, Appendix to Report of W. P. Blake, p. 9; Pacific R. R. Reports Vol. 5, 1857, p. 320, pl. 2, fig. 1, type Tejon Eocene, Grapevine Creek, Kern County, California.

Conrad evidently overlooked the fact that he had already used the name *linteum* with Cardium when he described the Mississippi fossil. This he later made the type of his new genus Veleda, [10] and Gabb in 1876[11] placed the species in his genus Cymbophora of the Mactridæ. Here Johnson left it in his annotated list of the Philadelphia Academy's types.[12] Whitfield had previously refigured the species[13] as *Veleda lintea.*

28. **Epitonium insecuritum** Hanna, new name

Epitonium (*Boreoscala*) *washingtonensis* Weaver & Palmer, Univ. Wash. Publ. Geol., Vol. 1, No. 3, 1922, p. 30, pl. 11, fig. 19, Eocene, McClarety Ranch, near Vader, Lewis County, Washington.

Not *Epitonium washingtonensis* Weaver, Univ. Wash. Publ. Geol., Vol. 1, No. 1, 1916, p. 43, pl. 4, figs. 46, 47, Oligocene, near Lincoln Creek Station, Washington.

The appearance of these two species with the same name, in the same series of publications and partially by the same author, is doubtless due to the employment over and over again of the hackneyed name "*washingtonensis.*" The practice leads to other bibliographical difficulties when species are transferred to other genera without cross references. The last *E. washingtonensis* must receive a new name; and the correct rendering of the first is *Epitonium washingtonense* Weaver.

29. **Fossarus barkeri** Anderson, new name

Fossarus dalli Anderson & Martin, Proc. Calif. Acad. Sci., 4th Ser., Vol. 4, 1914, p. 70, pl. 7, figs. 13a, 13b, Lower Miocene of Barker's Ranch, Kern River, Kern County, California.

Not *Trichotropis dalli* Whitfield, U. S. Geol. Surv. Monog. 24, 1895, p. 127, pl. 23, figs. 1-4, Miocene of New Jersey.

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[10] Amer. Journ. Conch., Vol. 6, 1871, p. 74.

[11] Proc. Acad. Nat. Sci. Phila. 1876, p. 306.

[12] Opt. cit. 1905, p. 17.

[13] Monograph 9, U. S. Geol. Surv. 1885, p. 172, pl. 23, figs. 20, 21.

That the above species belong to the same genus is evident upon an examination of the figures. Martin[14] has apparently correctly placed the New Jersey form in Fossarus. Mr. F. M. Anderson has therefore supplied the above substitute name.

30. **Fusinus arnoldi** (Cossmann)

Fusus rugosus Trask, Proc. Calif. Acad. Nat. Sci., Vol. 1, 1855, p. 41, [Pleistocene], San Pedro, California. — Arnold, Mem. Calif. Acad. Sci., Vol. 3, 1903, p. 226, pl. 4, fig. 7.

Fusus arnoldi Cossmann, Rev. Paleozool. Vol. 7, 1903, p. 215; new name for *F. rugosus* Trask, not Lamarck, 1804.

Fusinus traski Dall, Nautilus, Vol. 29, 1915, p. 54; new name for *Fusus rugosus* Trask, not Lamarck, 1804.—Dall, Bull. U. S. Nat. Mus., 112, 1921, p. 88.

Fusus rugosus was used by Lamarck in 1804, Sowerby 1820, and Grateloup 1847, before Trask. Cossmann noticed the homonym in 1903 and renamed it *F. arnoldi*, and was followed by Dall in 1915 who again renamed it *F. traski*. It is hoped that this notice may aid in stabilizing the name of this important species.

31. **Fusinus monksæ** Dall

Fusinus monksæ Dall, Nautilus, Vol. 29, 1915, p. 55; new name for

Fusus robustus Trask, Proc. Calif. Acad. Nat. Sci., Vol. 1, 1855, p. 41, [Pleistocene] San Pedro, California.

32. **Fusinus obtentus** Hanna, new name

Fusinus (*Priscofusus*) *lineatus* Dickerson, Univ. Calif. Publ. Geol., Vol. 7, 1913, p. 281, pl. 11, fig. 11 (not 12 as cited), Eocene, Marysville Buttes, Sutter County, California.

Not *Fusus lineatus* Quoy, Voyage of the Astrolabe, Zool., Vol. 2, 1832, p. 501, pl. 34, figs. 6-8, New Zealand, living.

The previous use of *lineatus* for a species of Fusus or Fusinus invalidates the name of the California fossil. Tryon[15] also mentions a *Fusus lineatus* of Menke but the reference has not been completed.

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[14] Maryland Geol. Surv. Miocene, 1904, p. 245.

[15] Man. Conch., Vol. 3, 1881, p. 68.

33. **Galeodea tuberculiformis** Hanna, new name

Morio (*Sconsia*) *tuberculatus* Gabb, Geol. Surv. Calif. Pal., Vol. 1, 1864, p. 104, pl. 19, fig. 57, Eocene, Martinez, etc., California.
Not *Cassidaria tuberculata* Risso, Hist. Nat. Eur. Mer., Vol. 4, 1826, p. 186.

It has been shown[16] that the type species of Cassidaria and Morio is the same as the type species of the earlier genus-name, Galeodea, and Sconsia cannot be used for greater than a sub-generic group. The use of the name *tuberculata* in Cassidaria by Risso invalidates it in Galeodea providing the earlier name represents a real species of this generic relationship. This it evidently does if we may rely upon the writings of other European paleontologists.

34. **Gilbertina** Ulrich

Gilbertina Ulrich, Harriman, Alaska Exp., Vol. 4, 1910, p. 140; Type *G. spiralis.*
Not *Gilbertina* Jordan & Starks, Proc. Calif. Acad. Sci., 2nd Ser., Vol. 5, 1895, p. 811, pl. 86; for *G. sigalutes,* n. sp. of fish from Puget Sound.

Ulrich questioned the plant relationship of this supposed fucoid. If subsequent study should show it to be of animal origin a new genus-name will be required because of a prior Gilbertina in zoology.

35. **Glycymeris larvata** Hanna, new name

Glycymeris conradi Dall, U. S. Geol. Surv. Prof. Paper 59, 1909, p. 107, pl. 11, fig. 2, Miocene [Pliocene] Coos Bay, Oregon.
Not *Axinea conradi* Whitfield, U. S. Geol. Surv. Monog. 9, 1885, p. 230, pl. 29, figs. 10-11, New Jersey.

Whitfield's reference of his New Jersey species to Axinea was in accordance with best usage at the time he wrote but the name Glycymeris has replaced it of late years. Therefore Dall's Oregon species requires a different name and *larvata* is hereby proposed.

36. **Glyphostoma oscilata** Hanna, new name

Pleurotoma (*Clathurella, Glyphostoma*) *dalli* Böse & Toula, Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt, Vol. 60, 1910, p. 252, pl. 13, fig. 27, Isthmus of Tehuantepec, [Miocene ?]

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[16] Dall, U. S. Geol. Surv. Prof. Pap. 59, 1909, p. 64, etc.

Not *Pleurotoma* (*Borsonia*) *dalli* Arnold, 1903, see p. —.
Not *Pleurotoma dalli* Verrill & Smith, Trans. Conn. Acad. Sci., Vol. 5, 1882, p. 451, pl. 57, figs. 1, 1a, East Coast of North America, living.

The Tehuantepec fossil was given a name which unfortunately had been used at least twice previously. Since very considerable collections from that general region have lately come to western museums for study the species is hereby renamed for use in forthcoming reports.

37. **Gyrodes insecuris** Hanna, new name

Natica (*Gyrodes*) *lineata* Dickerson, Univ. Calif. Publ. Geol., Vol. 8, 1914, p. 141, pl. 13, figs. 3a, 3b, Martinez Eocene, near Stewartsville, California.
Not *Natica lineata* Lamarck, An. sans Vert. Deshayes Ed. Vol. 8, 1838, p. 640; vide Tryon, Man. Conch, Vol. 8, 1886, pp. 29, 86, Philippines, living.

Dickerson's name is an exact homonym and therefore cannot stand in zoological literature, according to the rules of nomenclature.

38. **Gyrodes negligentus** Hanna, new name

Natica (*Gyrodes*) *alveata* Conrad, Journ. Acad. Nat. Sci., 2nd Ser., Vol. 4, 1858-60, p. 289, pl. 46, fig. 45, Tippah County, Mississippi.
Not *Natica alveata* Conrad, House Doc. 129, Projected Vol. 3, 33rd Congress, 1st Sess., 1855, App. to Prelim. Geol. Report of W. P. Blake, p. 10.—Conrad, Pacific R. R. Reports, Vol. 5, 1857, p. 321, pl. 2, figs. 8, 8a, Tejon Eocene, Grapevine Creek, Kern County, California.

In describing the Mississippi fossil Conrad evidently overlooked the fact that he had previously used the same name for a California Eocene species which properly belongs in Amauropsis or, as lately suggested, Ampullospira. A new name is therefore needed for the eastern species.

39. **Hamites klamathensis** Anderson, new name

Hamites armatus Anderson, Proc. Calif. Acad. Sci., 2nd Ser., Vol. 2, 1902, p. 89, pl. 5, figs. 130-132, Lower Chico Cretaceous near Henley, Siskiyou County, California.

Not *Hamites armatus* Sowerby, Mineral Conchology Vol. 2, 1817, p. 153, pl. 163; Vol. 3, 1821, p. 59, pl. 234, fig. 2.—d'Orbigny, Paleont. France, Terr. Cret. Vol. 1, p. 547, pl. 135.

40. **Hamites siskiyouensis** Anderson, new name

Hamites ellipticus Anderson, Proc. Calif. Acad. Sci., 2nd Ser., Vol. 2, 1902, p. 87, pl. 3, figs. 102-103; pl. 10, fig. 191, Chico Cretaceous, Southern Oregon.

Not *Hamites ellipticus* Mantell, Geol. Sussex, 1822, p. 123, pl. 23, fig. 9.

41. **Leda denominata** Hanna, new name

Leda milleri Dickerson, Univ. Calif. Publ. Geol., Vol. 8, 1914, p. 123, pl. 7, fig. 4, Martinez Eocene, near Stewartsville, California.

Not *Nuculana milleri* Gabb, Journ. Acad. Nat. Sci. Phila., 2nd Ser., Vol. 8, 1881, p. 346, pl. 44, figs. 22, 22a, Sapote, Costa Rica.

There is still some difference of opinion as to whether Leda or Nuculana shall be the genus-name of this well-known group of Pelecypoda. But in either case the Martinez species must have a different name because it obviously is generically related to the Costa Rican form but specifically different.

42. **Leda polynominata** Hanna, new name

Corbula gabbii Dall, Trans. Wagner Free Inst. Sci., Vol. 3, pt. 4, 1898, p. 840; new name for

Corbula alæformis Gabb, Geol. Surv. Calif. Paleo., Vol. 2, 1869, p. 177, pl. 29, fig. 63, Martinez or Tejon Eocene near Lower Lake Village, Lake County, California, which Stanton, (U. S. Geol. Surv. 17th Annual Report, 1895-1896, p. 1040, pl. 64, figs. 6, 7,) determined to belong to the genus Leda.

Not *Corbula aliformis* Conrad, Amer. Journ. Conch., Vol. 2, 1866, p. 76.

Not *Leda gabbii* Gabb, Geol. Surv. Calif. Pal., Vol. 2, 1869, p. 197.

The large species of Leda from Lower Lake, Lake County, California, is involved in a nomenclatorial tangle to an excessive degree. The only way out, in accordance with the rules, seems to be to rename it. Gabb described it as *Corbula alæformis,* but Dall renamed it *Corbula gabbii* because of the prior *Corbula aliformis* of Conrad. Stanton in 1895-96 discovered that it belonged to the genus Leda and not Corbula, and in this decision he has been followed by Dickerson.[17] But there was already a species named *gabbii* in Leda when Dall changed the name of *alæfomis*. It is therefore impossible to use the name *gabbii* for the Lower Lake species. The first *Leda gabbii* Gabb dates from 1869 and was applied to a fossil from various California formations which had in 1864 been recorded questionably by Gabb as his *Leda protexta* of New Jersey. Conrad cannot be considered as having had any hand in the naming of the species *gabbii;* his name appeared as *Nuculana gabbi*[18] and is an absolute *nomen nudum;* therefore it has no standing whatsoever in literature.

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[17] Univ. Calif. Publ. Geol., Vol. 8, 1914, p. 107.

43. **Lucina invalida** Hanna, new name

Lucina cretacea Whitfield, U. S. Geol. Surv. Monog. 9, 1885, p. 129, pl. 18, figs. 23-25, Eocene Haddonfield, New Jersey; name given to a shell figured by Conrad, Am. Journ. Conch., Vol. 5, pl. 9, fig. 14.

Not ? *Lucina cretacea* Gabb, Geol. Surv. Calif. Pal., Vol. 1, 1864, p. 177, pl. 30, fig. 255; Vol. 2, 1869, p. 243, Eocene, vicinity of Mt. Diablo, California.

Whitfield must be cited as the author of the name of the New Jersey fossil; Conrad published a figure but only named the shell on a museum label. It seems to be a fairly important species of the east coast and is therefore renamed herein as above.

44. **Marginella instabilata** Hanna, new name

Marginella pacifica Dickerson, Proc. Calif. Acad. Sci., 4th Ser., Vol. 7, 1917, p. 178, pl. 31, fig. 2, Oligocene, Greece Ranch, near Vader, Washington.

Not *Marginella pacifica* Pease, Amer. Journ. Conch., Vol. 3, 1868, p. 280, pl. 23, fig. 20, Paumotus Islands, living.

The name of the Washington species is an exact homonym and must therefore be replaced to conform to the rules of nomenclature.

45. **Melanella gabbiana** (Anderson & Martin)

Eulimella gabbiana Anderson & Martin, Proc. Calif. Acad Sci., 4th Ser., Vol. 4, 1914, p. 68, pl. 7, fig. 20, Lower Miocene, Kern County, California.

Melanella (*Melanella*) *gabbiana* (Anderson & Martin), Bartsch, Proc. U. S. Nat. Mus., Vol. 53, 1917, p. 316, pl. 38, fig. 3.

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[18] Check-list Eocene and Oliogcene Fossils. Smith. Miscellaneous collection No. 200, 1866, p. 3.

The notice of transfer of this species to Melanella is included herein because it might otherwise escape attention. The fossil came from a very important California formation, Lower Miocene of Kern River, Kern County.

46. **Melanella johnsoni** Hanna, new name

Melanella gabbiana PILSBRY & JOHNSON, Proc. Acad. Nat. Sci. Phila., 1917, p. 182, "Oligocene" San Domingo.

Not *Eulimella gabbiana* ANDERSON & MARTIN, Proc. Calif. Acad. Sci., 4th Ser., Vol. 4, 1914, p. 68, pl. 7, fig. 20, Lower Miocene, Kern County, California. Bartsch (Proc. U. S. Nat. Mus., Vol. 53, 1917, p. 316, pl. 38, fig. 3) has placed this species in the genus Melanella.

From the above it will be seen that a new name is required for the San Domingo species. The one selected is chosen in honor of Dr. Charles W. Johnson, the distinguished Curator of the Boston Society of Natural History.

47. **Modiolus complicatus** Hanna, new name

Modiola (*Lithodomus ?*) *inflata* WHITFIELD, U. S. Geol. Surv. Monog. 9, 1885, p. 197, pl. 26, figs. 1, 2, New Jersey.

Not *Mytilus inflatus,* TOUMEY & HOLMES, Pleis. Foss. South Carolina, 1855, p. 33, pl. 14, fig. 3.

Whitfield[19] and Dall[20] have both considered the South Carolina fossil to belong to the genus Modiolus, which makes necessary a new name for the New Jersey form.

48. **Modiolus trinominata** Hanna, new name

Modiolus inflatus DALL, U. S. Geol. Surv. Prof. Paper 59, 1909, p. 114, pl. 12, figs. 8, 9, Miocene, [Pliocene], Coos Bay, Oregon.

Not *Mytilus inflatus* TOUMEY & HOLMES, Pleis. Foss. South Carolina, 1855, p. 33, pl. 14, fig. 3, which Whitfield (U. S. Geol. Surv. Monog. 24, 1895, p. 39, pl. 6, figs. 3, 4;) and Dall (Trans. Wag. Free Inst. Sci., Vol. 3, pt. 4, 1898, p. 793;) have placed in *Modiolus.*

Not *Modiola* (*Lithodomus?*) *inflata* WHITFIELD, U. S. Geol. Surv. Monog. 9, 1885, p. 197, pl. 26, figs. 1, 2, New Jersey.

It appears from the literature that the name of the Oregon fossil is twice preoccupied; it therefore requires a new name. Dall considered the Coos Bay formation Miocene, but Howe has lately determined it to be Pliocene.

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[19] U. S. Geol. Surv. Monog. 24, 1895, p. 39, pl. 6, figs. 3, 4.

[20] Trans. Wag. Free Inst. Sci., Vol. 3, pt. 4, 1898, p. 793.

49. **Murex calamitus** Hanna, new name

Murex vaughani DICKERSON, Proc. Calif. Acad. Sci., Vol. 7, 4th Ser., 1917, p. 174, pl. 30, figs. 3a, 3b, Oligocene, Greece Ranch near Vader, Lewis County, Washington.

Not *Murex vaughani* MAURY, Bull. Am. Paleo., Vol. 4, No. 21, 1910, pp. 143-144, Oligocene, Florida.

Although these two species were named for different persons the name of the Washington fossil is an exact homonym and according to the rules cannot stand.

50. **Murex (Orinebra) rodeoensis** Clark, new name

Murex (*Ocinebra*) *packardi* CLARK, Univ. Calif. Publ. Geol., Vol. 8, August 30, 1915, p. 501, pl. 69, figs. 2, 11, Upper Miocene, (San Pablo), California.

Not *Murex packardi* DICKERSON, Proc. Calif. Acad. Sci., 4th Ser., Vol. 5, June 15, 1915, p. 69, pl. 9, figs. 6a, 6b, Upper Eocene, Cowlitz River, Vader, Washington.

Only a few weeks intervened between the duplication of the name *Murex packardi*, and the Miocene species, being the latest to appear, requires a new name; this has been supplied, as above, by Dr. Bruce L. Clark of the Department of Paleontology, University of California.

51. **Murex temalentus** Hanna, new name

Murex (*Ocinebra*) *concinna* NOMLAND, Univ. Calif. Publ. Geol., Vol. 10, No. 14, 1917, p. 236, pl. 12, figs. 6, 6a, Etchegoin Pliocene, California.

Not *Murex concinnus* REEVE, 1845, Conch., Icon. Sp. 104, pl. 25.—TRYON, Man. Conch., Vol. 2, 1880, p. 227.

The name of the Pliocene species of California is homonymous with a living form and therefore cannot be accepted, according to the rules of nomenclature.

52. **Mya inopia** Hanna, new name

Cryptomya ovalis CONRAD, Proc. Acad. Nat. Sci. Phila., Vol. 8, 1856, pp. 312-316.—CONRAD, Pac. R. R. Reports, Vol. 6, 1857, p. 69, 73, Monterey, California. — ARNOLD, Bull. U. S. Geol. Surv. 398, pl. 44, fig. 5. — ARNOLD, Bull. 396, U. S. Geol. Surv. 1909, pl. 22, fig. 5, cited from "Etchegoin," California.

Mya (***Cryptomya***) ***ovalis*** Conrad, Clark, Univ. Calif. Publ. Geol., Vol. 8, 1915, p. 479, pl. 60, figs. 3, 4, cited from San Pablo, Miocene, California.
Not ***Mya ovalis*** Pultenay, Cat. Birds, Shells, etc., Dorsetshire, 1799, p. 27.
Not ***Mya ovalis*** Röemer, Nord. Oolith, [Verst. Norddent, Kreidegeb.] 1839, p. 42, pl. 19, fig. 28.
Not ***Mya ovalis*** Martin, see Koninck, Desc. des Anim. Fossil, Belgique, 1844, (1841) p. 74, pl. H, fig. 2; which was a new name for ***Unio uniformis*** Sowerby, not Goldfuss.

It is unfortunate that so well known a fossil as this should require a new name because of its prior use in an ancient, obscure publication; but no other course appears possible if the rules of nomenclature are to be adhered to. In the references to Röemer and Koninck the bracketed matter is taken from Sherborn, Index Animalium, 1922. It also appears that Sowerby named a species "*Mya ovalis* prior to the use of the name by Conrad.

53. **"Natica andersoni"** Clark

Natica (*Neverita*) ***recluziana andersoni*** Clark, Univ. Calif. Publ. Geol., Vol. 11, 1918, p. 168, pl. 20, figs. 3, 10, 11, 12, San Lorenzo, Oligocene California.
Not ***Natica anderssoni*** Strebel, Zool. Jahr. Syst., Vol. 24, 1906, p. 142, Magalhaen.

The case of this subspecies is similar to *Siphonalia clarki* Dickerson. It is my belief that the differences of spelling are sufficient to warrant their retention, although cases of replacement for less substantial reasons might be cited.

54. **Natica fiasco** Hanna, new name

Neverita globosa Gabb, Geol. Surv. Calif. Pal., Vol. 2, 1869, p. 161, pl. 27, fig. 39, Eocene near New Idria, California.
Not ***Natica globosa*** King, Zool. Journ., Vol. 5, 1830-1831, p. 344, Straits of Magellan, living; Tryon stated this is ***N. patigonica*** Philippi.
Not ***Natica globosa*** Jeffreys, Proc. Zool. Soc. London, 1885, p. 33, "Morocco and Cape Verde Islands."

Gabb's species questionably belongs to the sub-group Neverita, which even modern conchologists fail to raise to higher rank than a sub-genus. The only safe procedure under such circumstances is to leave the species in Natica. Attempts to place fossil species in a classification based upon living forms can be carried so far as to produce endless confusion. In this case the western fossil has a name preoccupied twice in Natica. It therefore cannot be transferred without a new name, but this seems the lesser of two evils.

55. **Odostomia andersoni** (Bartsch)

Odostomia (Evalea) andersoni BARTSCH, Proc. U. S. Nat. Mus., Vol. 52, 1917, p. 667.

Eulimella californica ANDERSON & MARTIN, Proc. Calif. Acad. of Sci., 4th Ser., Vol. 4, 1914, p. 67, pl. 7, figs. 19a, 19b, 19c, Lower Miocene, Kern River, California.

Not *Odostomia (Evalea) californica* DALL & BARTSCH, Bull. U. S. Nat. Mus., 68, 1909, p. 208, pl. 24, fig. 2, San Diego, California.

56. **Odostomia ochsneri** (Anderson & Martin)

Eulimella ochsneri ANDERSON & MARTIN, Proc. Calif. Acad. Sci., 4th Ser., Vol. 4, 1914, p. 66, pl. 7, figs. 23a, 23 b, Barkers Ranch, Kern County, California, Lower Miocene.

An examination of the cotypes, Nos. 138, 139 (C. A. S. Coll.) shows that this species belongs with *E. andersoni* in Odostomia (Evalea) as defined by Bartsch. The name therefore does not conflict with *Melanella ochsneri* Bartsch[21] from the Galapagos Islands, as might be suspected from the original generic reference. The reference to the University of California as being the depository of the original material of *M. ochsneri* Bartsch is an error due to the transmission of wrong data with the collection by the person who then had the collection in charge. The material is a part of the collection made by the California Academy of Sciences Expedition to the Galapagos Islands in 1905-1906, and as received back at the Academy consists of 14 specimens of the species labelled "Banks Bay, Albemarle Island," and 17 specimens labelled "Tagus Cove, Albemarle Island." No designated type was received.

57. **"Ostrea corrugata"** Nomland

Ostrea titan corrugata NOMLAND, Univ. Calif. Publ. Geol., Vol. 10, 1917, p. 306, pl. 16, fig. 1, pl. 17, fig. 1, Santa Margarita Miocene near Coalinga, California.

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[21] U. S. Nat. Mus. Proc., Vol. 53, 1917, p. 305, pl. 35, fig. 1.

Not *Ostrea corrugata* Brocchi, Conch. Fossil Subapennina, 1814, p. 670, pl. 16, figs. 14-15.

The name chosen by Nomland for the California fossil is an exact homonym and therefore unacceptable in accordance with the present rules of nomenclature. The subspecies is believed to be merely a variation of the protean *O. titan*, well worth recording as such, but scarcely deserving of a name.

58. **"Pachymelania"** White

Pachymelania White, U. S. Geol. Surv. Bull. 128, 1895, p. 50; Type *P. cleburni;* four other species referred to genus.

Not *Pachymelania* E. A. Smith, Conchologist, Vol. 2, 1893, pp. 141-142; new name to be applied to *Nerita aurita* Müller to replace *Claviger* Haldeman.

White's name is preoccupied by two years. In his description of it he stated that the group "differs from that genus [Goniobasis] in the moderate massiveness of the test and in a general habitus which is readily observable but difficultly describable." It would seem that when a group differs so little that the characters cannot be pointed out they are not worth considering in a scheme of nomenclature. Therefore I will not encumber literature with a new name.

Haldeman's Claviger has been a popular target for criticism. It is preoccupied by Preyssler, 1790 (in Coleoptera), and has been renamed at least three times. Pachymelania E. A. Smith, 1893; Hemipirena, Roverato, 1899; and Clavigerina, von Martens, 1903.

59. **Pecten binominatus** Hanna, new name

Pecten (*Pseudamusium*) *andersoni* Dall, Sci. Res. Canadian Arctic Exp. Vol. 8, 1918, Part A, p. 19a, pl. 2, figs. 7, 8, Dolphin and Union Strait, Arctic Ocean; (Reference from Dall, Bull. 112, U. S. Nat Mus. 1922.)

Not *Pecten* (*Plagiopecten*) *andersoni* Arnold, U. S. Geol. Surv. Prof. Paper 47, 1906, p. 82, pl. 26, figs. 5-8, Miocene, Zayante Creek, Santa Cruz County, California.

The name of the recently described living species from the Arctic Ocean conflicts with the well-known Miocene species of California; a new name is therefore required.

60. **Pecten calamitus** Hanna, new name

Pecten (*Propeamusium*) *levis* MOODY, Univ. Calif. Publ. Geol., Vol. 10, 1916, p. 56, pl. 2, figs. 2a, 2b, 2c, 2d, Fernando Pliocene, Los Angeles, California.

Not *Ostrea lævis* MATON & RAKETT, Trans. Linn. Soc., Vol. 8, 1807, p. 100; this is *Pecten tigrinus* MÜLLER according to VON TEPPNER, Foss. Cat. pt. 15, 1922, p. 141.

Not *Pecten lævis* POITEZ & MICHAUD, Gal. Moll. Mus. Donai, Vol. 1, 1838-1844, p. 81, pl. 50, fig. 4.

The spelling of the Pliocene California species is apparently an error in copying and should be corrected to *laevis*, which is correct. The previous use of the name forbids its application to the western shell.

61. **"Pecten clarkensis"** Hall & Ambrose

Pecten clarkensis HALL & AMBROSE, Nautilus, Vol. 30, 1916, p. 68, Horsetown Cretaceous near Milpitas, San Jose Quadrangle, California.

Not *Pecten clarkeanus* ALDRICH, Harris, Bull. Am. Paleo., No. 2, 1895, p. 68, pl. 5, fig. 11, Eocene, Alabama.

These two names are similar but seem sufficiently distinct to stand according to present rules. Anyway, it is doubtful if the Cretaceous fossil can ever be recognized unless the type specimen be found, because it has not been figured.

62. **Pecten diabloensis** Clark, new name

Pecten gabbi CLARK, Univ. Calif. Publ. Geol., Vol. 11, 1918, p. 131, pl. 15, figs. 1-2, Oligocene near Muir Station, Contra Costa County, California.

Not *Pecten gabbi* DALL, Trans. Wag. Free Inst. Sci., Vol. 3, pt. 4, 1898, p. 717, pl. 29, fig. 3, "Oligocene" of Antigua and San Domingo.

The name of the California species, according to the rules, must be replaced, and Professor Clark's attention having been called to it, he proposes to denote it as above in a forthcoming monograph of West American Oligocene Pelecypoda. The West Indian species was originally called *P. paranensis* by Gabb, but according to Dall is not d'Orbigny's species of that name.

63. **Pecten invalidus** Hanna, new name

Pecten (*Plagioctenium*) *cooperi* Arnold, Prof. Paper 47, U. S. Geol. Surv. 1906, p. 124, pl. 49, figs. 2-4, Pliocene, Pacific Beach, San Diego County, California.

Not *Pecten cooperi,* E. A. Smith, Fauna and Geography of Maldive and Laccadive Archipelagos, Vol. 2, 1903, p. 621.

64. **Pecten impostor** Hanna, new name

Pecten proteus Nomland, Univ. Calif. Publ. Geol., Vol. 10, 1917, p. 232, pl. 6, figs. 2, 2a, 2b, 2c, Etchegoin Pliocene, California.

Not *Pecten proteus* Sowerby, Thes. Conch., 1847, p. 59, pl. 13, figs. 53, 54. Four other references are given to the name by Von Teppner in C. Diener, Foss. Catalogue, Pars 15, p. 197, 1922.

Nomland's name is an exact homonym of the well-known species of Sowerby. The other references given by C. Diener have not been checked. There is also a *Pecten protei* Munster[22] (cited by d'Orbigny in his Prodrome) which would probably throw out even Sowerby's name upon a strict application of the rules. Monterosato[23] proposed the genus name "Proteopecten" for some species named *"Pecten proteus"* but not the one of Moody.

65. **Periploma binominata** Hanna, new name

Periploma undulata Clark, Univ. Calif. Publ. Geol., Vol. 11, 1918, p. 136, pl. 15, figs. 3, 4, Oligocene, Contra Costa County, California.

Not *Periploma undulata* Verrill, Trans. Conn. Acad. Sci., Vol. 6, 1885, p. 433, off coast of New England, living.

The name which was bestowed on the California fossil is unfortunately preoccupied for a living species of the east coast of the United States, and in the absence of Professor Clark, the above is proposed as a substitute.

66. **Pitaria ? prænominata** Hanna, new name

Meretrix dalli Dickerson, Univ. Calif. Publ. Geol., Vol. 8, 1914, p. 135, pl. 11, figs. 2a, 2b, Martinez Eocene, California.

Not *Meretrix dalli* Cossmann, Notes Compl. 1894, p. 10, pl. 1, figs. 9, 10; vide Dall, Trans. Wag. Free Inst. Sci., Vol. 3, pt. 6, 1903, p. 1239.

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[22] Beitrag. 1841, Vol. 4, p. 72, pl. 7, fig.6.

[23] Journ. Conch., Vol. 47, 1899, p. 187.

Harris[24] as well as Dall placed Cossmann's species in the synonymy of "*Grateloupia* (*Cytheriopsis*) *hydana* Conrad," but the former cited the reference as "Cossmann, Notes Comp. 1893, p. 11, pl. 1, figs. 9, 10." I have not checked it to ascertain who is correct.

Unfortunately Dickerson called one of the "zones" of the Martinez the "*Meretrix dalli* zone," but since the species name is an exact homonym it must be discarded.

The hinge of Dickerson's Martinez species has not been described and from the figures it appears that the type material is too poorly preserved for such a study; therefore the proper generic reference cannot be ascertained. But since in shape it resembles somewhat *Pitaria californiana* (Conrad) of the Type Tejon Eocene it would seem best to place the species temporarily in that genus. Such procedure will probably not interfere with Weaver's *Pitaria dalli of* 1916.[25]

67. **Proceratites** Kittl

Proceratites KITTL, Abhandl. K.-K.-Geol. Reichsanstalt, Wien, Vol. 20, 1903, p. 28; type, "*Ceratites plicatus*" Waagen.

Xenaspis WAAGEN, Mem. Geol. Surv. India, Pal., India, Ser. 13, Salt Range Fossils, Vol. 2, 1895, p. 161.—HYATT & SMITH, U. S. Geol. Surv. Prof. Pap. 40, 1905, p. 115. Type species *Xenodiscus plicatus* Waagen.

Not *Xenaspis*, OSTEN-SACKEN, Bull. Soc. Entomology, France, Ser. 6, Vol. 1, 1881; insects.

The name Xenaspis cannot be used for the group of Cephalopoda as Waagen proposed but it appears that Proceratites of Kittl can replace it since the type species is the same.

68. **Pyramidella (?) præcursor** Hanna, new name

Eulima smithi VAN WINKLE, Univ. Wash. Publ. Geol., Vol. 1, No. 2, 1918, p. 85, pl. 7, fig. 22, Lower Oligocene, Greece Ranch, near Vader, Lewis County, Washington.

Not *Eulima smithi* REAGAN, Trans. Kans. Acad. Sci., Vol. 22, 1909, p. 223, pl. 6, fig. 61.

Not *Turbonilla smithii* VERRILL, Proc U. S. Nat. Mus., Vol. 3, 1880, p. 380, east coast of North America, living.

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[24] Bull. 31, Amer. Paleo. 1919, p. 152.

[25] Univ. Wash. Publ. Geol., Vol. 1, No. 1, 1916, p. 41.

Verrill,[26] two years after describing his species, placed it in the genus Eulimella. It belongs to the same genus as the fossil described by Reagan in 1909 from the Quillayute formation (Miocene?) of Washington. In working over his types, deposited in the U. S. National Museum, Dall[27] has stated that the Washington form is not distinct from "*Eulima washingtoni,*" described by Reagan at the same time and that they probably belong to the genus "Strombiformis." The difference in the shape of the whorls in *E. smithi* Reagan is due to decortication; a new name for it is, therefore, not required.

Van Winkle's Washington fossil is unrecognizable from the figure and if the description is correct in regard to the presence of a canal it does not belong near the group formerly called Eulima or Eulimella, now Melanella, but may be Pyramidella, although no mention was made of plications. The specimen seemed to be well preserved and the species can probably be recognized when further collections from the same locality are studied.

69. **Rimetella** Hanna, new name

Ectinochilus COSSMANN, Cat. Coqu. Foss. Eocene Paris, Vol. 4, 1889, p. 91; new section of *Rimella* Agassiz; type species *Strombus canalis* Lamarck. Not *Ectinochila* CHAUDOIR, Coleoptera Nov., Vol. 1, 1883, p. 21; type species *E. tessellata* Chaudoir, new species.

According to modern methods of generic subdivision it appears certain that sooner or later the West American species formerly referred to Rimella Agassiz will be assigned to different groups and some of them will almost certainly fall in that which Cossmann named Ectinochilus with *Strombus canalis* Lamarck as type.[27a] But Cossmann's name is preoccupied in Insecta by Ectinochila, a name which differs only in generic ending. Taxonomists generally have considered such differences in endings as insufficient and have replaced the latest one to be used. No better illustration of the need of such action comes to mind than the present case. If Cossmann's name be used as a subgenus and a West American species be referred to the combination, *Rimella* (*Ectinochilus*) *canalifera* would result; to make the names agree in gender would necessitate changing Ectinochilus to Ectinochila, an absolute replica of Chaudoir's name. If the genus and species must agree in gender, as the rules demand, the subgenus must necessarily agree also, it would seem, and taxonomists have generally assumed that this is true. The question of the usefulness of a polynomial nomenclature involving subgenera, subspecies and other subdivisions need not be discussed in this connection.

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[26] Trans. Conn. Acad. Sci., Vol. 5, 1882, p. 538, pl. 58, fig. 18.

[27] Amer. Journ. Sci., Vol. 4, 5th series, No. 22, October 1922, pp. 305-314.

[27a] Since this was written Clark & Palmer (Univ. Calif. Publ. Geol., Vol. 14, 1923, p. 279) have included three west American species in Ectinochilus Cossmann.

The type species of the new name, Rimetella, will be *Strombus canalis* Lamarck.

70. **"Siphonalia clarki"** Dickerson

Siphonalia clarki DICKERSON, Proc. Calif. Acad. Sci., 4th Ser., Vol. 4, 1914, p. 121, pl. 11, figs. 4a, 4b, Eocene, Roseburg Quadrangle, Oregon.

Not *Siphonalia clarkei*, WOODS, Proc. Roy. Soc. Tasmania, 1875, p. 138.

The difference in spelling of the two above names is so slight that some persons might replace the latest one on the grounds of homonymy. But it seems to me that it should stand although the similarity is confusing. Obviously the species were named for different persons.

71. **Smithoceras** Hanna, new name

Polycyclus, MOJSISOVICS, Verhandl. K.-K. Geol. Reichsanstalt, Wein 1889, p. 281. Type *Ammonites nasturtium Dittmar.* HYATT & SMITH, U. S. Geol. Surv. Prof. Ppr. 40, 1905, p. 201.

Not *Polycyclus* LAMARCK, 1815, Mollusca and Polyzoa, vide Agassiz, Nomenclator Zoologicus, and Scudder, Nomenclator Zoologicus, U. S. Nat. Mus. Bull. 22, 1882, p. 257.

A species belonging to the above group from Upper Triassic of Shasta County, California, was named *nodifer* by Hyatt & Smith. But Polycyclus was otherwise used by Lamarck and it is proposed that Smithoceras be used for the Triassic fossils with *Ammonites nasturtium* Dittmar as type.

72. **Spondylus fucatus** Hanna, new name

Spondylus striatus PACKARD, Univ. Calif. Publ. Geol., Vol. 13, 1922, p. 422, pl. 29, Cretaceous, Santa Ana Mountains, California.
Not *Spondylus striatus* K. SCHREIBERS, Vers. Conch., Vol. 2, 1793, p. 158.
Not *Spondylus striatus* GOLDFUSS, 1832 (Petref. German. 3 Vols. 1826-1844), cited by d'Orbigny, Paleo. France, Vol. 3, p. 660, pl. 453.

Packard's name is a homonym and must be replaced to accord with present rules of nomenclature.

73. **Surcula binotata** Hanna, new name

Turris plicata WARING, Proc. Calif. Acad. Sci., 4th Ser., Vol. 7, 1917, p. 68, pl. 9, fig. 3, Cretaceous, Simi Hills, Los Angeles County, California.
Not *Pleurotoma plicata* GRATELOUP, Conch. Foss. Terr. Tert. Adour. 1847, pl. 2, n. 20, fig. 36; vide Tryon, Man. Conch. Vol. 6.
Not *Pleurotoma plicata* LAMARCK, Mem. Foss. Env. Paris, Deshayes edition Vol. 2, 1824, p. 448, pl. 66, figs. 14-16, Eocene of France.

Dall[28] referred to a *Pleurotoma plicata* of Lamarck and also of C. B. Adams but no attempt has been made to trace the references further than the above. That Waring's species belongs to the same genus as Lamarck's fossil from France is apparent upon a comparison of the figures. This makes a new name for the Cretaceous form necessary.

74. **Surcula hobsoni** Hanna, new name

Pleurotoma (*Drillia*) *dalli* TOULA, Jahrbuch der Kaiserlich-Koniglichen Geologischen Reichsanstalt, Vol. 61, 1911, p. 506, pl. 30, fig. 12, Isthmus of Panama, (Miocene).
Not *Pleurotoma* (*Clathurella, Glyphostoma,*) *dalli* BÖSE & TOULA, 1910; see p. —.
Not *Pleurotoma* (*Borsonia*) *dalli* ARNOLD, 1903; see p. —.
Not *Pleurotoma dalli* VERRILL & SMITH, Trans. Conn. Acad. Sci., Vol. 5, 1882, p. 451, pl. 57, figs. 6, 6a, East Coast of North America, living.

The name of the Panama fossil is at least thrice preoccupied. Western paleontologists are now using Gatun species for correlation in that general region of both North and South America, and the species is therefore renamed to make it available for their use.

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[28] Trans. Wagner Free Inst. Sci., Vol. 3, pt. 1, p. 41.

The species name is chosen in honor of Mr. Joseph W. Hobson, Recording Secretary of the California Academy of Sciences.

75. **Surcula evermanni** Hanna, new name

Turris pulchra DICKERSON, Proc. Calif. Acad. Sci., 4th Ser., Vol. 5, 1915, p. 71, pl. 10, figs. 4a, 4b, Upper Eocene, Cowlitz River, near Vader, Washington.

Not *Pleurotoma pulchra* "GRAY M. S.," Reeve Conch. Icon. Vol. 1, 1843, sp. 351, pl. 38, and of other authors.

Not *Turris pulchra* "BOLTEN," ROEDING Mus. Boltenianum (2) 1798, p. 123.

Dickerson's name must be replaced because of a prior *Turris pulchra* of Bolten and the Washington species is probably congeneric with the species usually called *Pleurotoma pulchra* Gray.

The new name is in honor of Dr. Barton Warren Evermann, Director of the California Academy of Sciences.

76. **Surcula polyappellatia** Hanna, new name

Drillia ornata DICKERSON, Proc. Calif. Acad. Sci., 4th Ser., Vol. 5, 1915, p. 71, pl. 10, fig. 3, Upper Eocene of Cowlitz River, southern Washington.

Not *Pleurotoma ornata* HINDS, Voy. Sulphur, Zool., 1844-45, p. 25, pl. 7, fig. 21.

Not *Pleurotoma ornata* D'ORBIGNY, Ramon de la Sagra's Cuba, Vol. 2, 1839-1845, p. 171, pl. 23, figs. 26-28, which Tryon (Man. Conch. Vol. 6, p. 362,) placed in *Drillia*.

Not *Pleurotoma ornata* DE FRANCE, Grateloup, Pleurotoma, 1847, pl. 3, m. 21, fig. 27, pl. 2, fig. 63.

The above are not the only instances of the use of the name *ornata* for closely related turrids. But a comparison of these shows that some at least are congeneric and the later names must be replaced. It is not believed that the generic nomenclature of the family has yet been stabilized in spite of recent revisions; therefore, use is made of the name Surcula since it is familiar to western paleontologists. It seems that Turricula may be applied to many of the species heretofore referred variously to Drillia, Surcula, Turris, and Pleurotoma, although that name was long used in Mitridæ.

77. **Phos dumbleana** Anderson, new name

Pleurotoma (*Clathurella*) *dumblei* Anderson, Proc. Calif. Acad. Sci., 3rd Ser., Vol. 2, 1905, p. 204, pl. 15, figs. 60, 61, Lower Miocene, Kern River, Kern County, California.

Not *Pleurotoma* (*Drillia*) *dumblei* Harris, Proc. Acad. Nat. Sci. Phila., 1895, p. 59, pl. 5, fig. 2, Eocene, Smithville, Texas. Casey (Trans. St. Louis Acad. Sci. Vol. 14, 1904, p. 154) has placed this species in his genus Surculoma.

"The name of the well-known California fossil is unfortunately a homonym and must be replaced according to the accepted rules of nomenclature. A re-examination of the type specimen shows that it belongs to the genus Phos as now recognized."—F. M. A.

78. **Tellina insurana** Hanna, new name

Tellina tenuistriata Davis, Journal of Geology, Chicago, Vol. 21, 1913, p. 457, Jurassic, California.

Not *Tellina tenuistria* [*or tenuistriata*] Deshayes, Coq. Foss. Paris, Vol. 1, 1824, p. 80, pl. 11, figs. 9, 10.

Not *Amphidesma tenuistriata* [*or tenuistria*] Sowerby in Fitton, Trans. Geol. Soc. London, 1836, p. 239, pl. 16, fig. 7.

Cossmann & Pissaro[29] refer to Deshayes' name as "*tenuistriata*," although Newton[30] has it "*tenuistria*." d'Orbigny in 1847 renamed Sowerby's species "*sub-tennistriata*" because of Deshayes' previous name, but Cossman & Pissaro spell it "*subtenuistria*." Original sources need to be consulted to determine which is correct. Under any circumstances the California fossil requires a different name.

79. **"Tritonium eocenicum"** Weaver

Tritonium eocenicum Weaver, Univ. Calif. Publ. Geol., Vol. 4, Martinez Eocene of California.

Not *Triton eocense* Whitfield, U. S. Geol. Surv. Mon. 18, pp. 192, 346, pl. 24, figs. 4, 5, Eocene, Green Marls, New Jersey.

A strict application of the rules would probably require replacement of the name "*Tritonium eocenicum*," or at least a correct rendering of the specific name to possibly "*eocenicense*." But before doing so it would be well to determine that it is a recognizable species, a matter in which the present writer has some doubt. It was not fully described or well figured.

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[29] Icon. Com. Foss. Eoc. Paris, Vol. 1, 1904-1906, p. 12, pl. 7.

[30] Brit. Olig. and Eoc. Moll. Cat. Brit. Mus. 1891, p. 75.

80. "Turris coli" Dall

Turris coli DALL, Prof. Pap. 59, U. S. Geol. Surv. 1909, p. 26, pl. 4, fig. 2, Miocene [Empire Pliocene] Coos Bay, Oregon.

Not *Pleurotoma colus* DRYARD, Mem. Geol. Soc. France, Vol. 2, 1837, p. 291, pl. 20, fig. 21.

The last cited publication has not been consulted, so it cannot be stated if these two species are congeneric or not. Future students of Oregon paleontology should determine this point and emend the nomenclature if necessary.

81. "Turris packardi" Weaver

Turris packardi WEAVER, Univ. Wash. Publ. Geol., Vol. 1, No. 1, 1916, p. 55, pl. 5, fig. 64, Oligocene, near Lincoln Creek Station, Washington.

Not *Pleurotoma packardii* VERRILL, Amer. Journ. Sci., Vol. 5, 1872, p. 15, pl. 29, fig. 59, East Coast of North America, living.

Under the current method of subdividing the groups of species in the Turridæ the above two probably would not fall into the same assemblage, but the necessary study has not been given to them to determine the matter finally. Attention is called to the names here in order that the next person who studies the Washington fauna may have the records readily accessible.

82. **Turritella polynominata** Hanna, new name

Turritella conica WEAVER, Univ. Calif. Publ. Geol., Vol. 4, 1905, p. 118, pl. 13, fig. 2, Martinez Eocene, California.

Not *Turritella conica* KLIPSTEIN, Beitrag Geol. Kenntu. oestl. Alpen, 1845, p. 173, pl. 11, fig. 6, which was renamed "*Cerithium subconica*" by d'Orbigny in 1874 because of a prior *Turritella conica* of Blainville in 1827 but of which the reference could not be completed.

Not *Turritella conica* SOWERBY in Murchison, Silurian Syst. 1839, pl. 3, figs. 7 and 8, Old Red Sandstone of England.

The name of the Martinez species is an exact homonym and according to the rules cannot stand.

83. **Turritella socordia** Hanna, new name

Turritella tricarinata BURWASH, Pros. & Trans. Roy. Soc. Canada, Vol. 7, 1914, Sec. 4, p. 81, Cretaceous, Queen Charlotte Islands, B. C.

Not *Turritella tricarinata* KING, Zool. Journ., Vol. 5, 1830-1831, p. 346, Valparaiso, Chile, living.

The specimen figured by Burwash is rather poorly preserved and perhaps might have been left unnamed, but I do not feel competent to judge of this matter. It certainly cannot stand under *tricarinata* according to the rules of nomenclature and it would seem best to rename it under the circumstances.

84. **? Venus ensifera** Dall

Venus ensifera DALL, U. S. Geol. Surv. Prof. Pap. 59, 1909, p. 122, new name for

Venus lamellifera CONRAD, Geol. U. S. Exp. Exp. 1849, App. 1, p. 724, pl. 17, figs. 12, 12a, Miocene, Astoria, Oregon.

Not *Venus lamellifera* CONRAD, Journ. Acad. Nat. Sci. Phila., Vol. 7, 1837, p. 251, pl 19, fig 19, Coast of California, which Dall (Bull. 112, U. S. Nat. Mus. 1921, p. 44) placed in Venerupis.

Not *Venus lamellifera*, Proc. Zool. Sov. London, 1856, p. 214.

85. **Yoldia (portlandia) astoriana** Henderson

Yoldia (Portlandia) astoriana HENDERSON, Nautilus, Vol. 33, 1920, p. 122, new name for

Nucula impressa CONRAD, Geol. U. S. Exp. Exp. 1849, p. 723, pl. 18, fig. 7, Astoria, Oregon, Miocene.

Not *Nucula impressa* (?) HALL, in Fremont Rept. Exp. Exped. to Rocky Mts. Oregon and Calif. U. S. Senate Doc. 174, 28th Cong., 2nd Sess. (Corresponding House Doc. 166) 1845, p 308, pl. 3, fig. 3.

Not *Nucula impressa* SOWERBY, Mineral Conchology, Vol. V, 1825, p. 118, pl. 475, fig. 3.

Yoldia (Portlandia) impressa CONRAD, Dall, U. S. Geol. Surv. Prof. Pap. 59, 1909, pp. 105, 154.

Attention is called to the fact that Henderson has renamed Conrad's Oregon species because it is likely to be overlooked. At the same time he renamed Hall's *"Nucula impressa"* as *Yoldia fremonti."* d'Orbigny also has a *Nucula impressa* dating from 1843 which he renamed *N. cornueliana* in 1847.

Howe's new name, *"Leda subimpressa"*[31] referred questionably to Dall's interpretation[32] of *Yoldia impressa* Conrad may possibly be a synonym of *Yoldia astoriana* Henderson.

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[31] Howe, Univ. Calif. Publ. Geol., Vol. 14, 1922, p. 97.

[32] U. S. Geol. Surv. Prof. Pap. 59, 1909, p. 105.

PROCEEDINGS

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XI

VOGDESELLA, A NEW GENUS-NAME FOR A PALEOZOIC CRUSTACEAN

BY

FRED BAKER

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In working over the manuscript of a new addition to the Bibliography of Paleozoic Crustacea by the late General Anthony W. Vogdes I note that Arthur Wade[1] is credited with a description of the genus Melanella.

A type species was not designated by Wade, but *Jonesella obscura* Ulrich[2] was stated to belong in the new genus and was indicated thus: "*Melanella* (*Jonesella*) *obscura.*" Then followed "*Melanella hemidiscus* gen. et sp. nov."; (pp. 451, 452, figs. 9a, 9b; Black shales of Gwern-y-brain).

According to Scudder's Index Zoologicus, Melanella is preoccupied as follows:

Melanella Bory, Polyg., 1824, A.
Melanella Bowditch, Moll., 1827, S.
Melanella Swainson, Moll., 1840, A.

The second reference should read:

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[1] Wade, Arthur. On the Llandovery and Associated Rocks of Northeastern Montgomeryshire; Quart. Jour. Geol. Soc. London, Vol. 67, Aug. 31, 1911, p. 451.

[2] Ulrich. Geol. Minn., Geol. Nat. Hist. Surv. Minn., Vol. 3, pt. 2, 1897, pp. 667, 668.

"Melanella Bowditch, Elem. Conch., Vol. 1, 1822, p. 27." according to Bartsch.[3]

The genus may therefore be known by the new name Vogdesella, given in honor of the late General Vogdes, with *Jonesella obscura* Ulrich, the species first mentioned by Wade, as the type.

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[3] Bartsch, Proc. U. S. Nat. Mus., Vol. 53, p. 302.

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XII

NOTES ON THE HERPETOLOGY OF NEW MEXICO, WITH A LIST OF SPECIES KNOWN FROM THAT STATE

BY

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So fragmentary and widely scattered are the published notes on the amphibians and reptiles of New Mexico that one who has not looked into the matter with care could hardly avoid the opinion that here is an almost untouched field. This was my opinion until recently, when I had occasion to gather the fragments and prepare a list of the species known from this state and of the publications in which they are mentioned. Additional information has been derived from specimens in the National Museum and other collections. While it is probable that some records may have been overlooked, the resulting list of more than eighty species and subspecies surprised me. This list, with data on various species, seems worthy of publication as a basis upon which to build a broader knowledge of the herpetology of New Mexico. It is only that, for its preparation has involved no critical study of specimens.

The geographical limits of New Mexico have been changed at various times. Texas gained its independence from Mexico in 1836 and claimed territory from its present boundary west to the Rio Grande. This claim was quieted by payment, by the United States, of $10,000,000. At the close of the Mexican War, in 1848, a great area, from the Pacific Ocean east to the Rio Grande and south to the Gila River, was ceded to the United States, Mexico receiving $15,000,000 as indemnity. In 1850, the Territory of New Mexico was formed. Its eastern boundary was the present one extended north to the Arkansas River, but its western boundary was formed by the Colorado River. In 1853, the Gadsden Purchase, for $10,000,000, extended the southern boundary from the Gila River to the present international line. In 1861 that part of New Mexico north of the 37th parallel, including most of the territory between the Rio Grande and the Arkansas and Cimarron rivers, became part of Colorado. What is now Nevada south of latitude 37° was part of New Mexico prior to 1863, when it, together with the rest of the western half of New Mexico, became the new Territory of Arizona.

These various changes require consideration in drawing up a list of the amphibians and reptiles for some of the older records from New Mexico are based upon specimens taken in regions which do not form part of the present state. Thus, the specimens recorded as collected between the Arkansas and Cimarron rivers, New Mexico, probably came from Colorado. Fort Defiance, New Mexico, is now in Arizona. Many specimens recorded as from Fort Bliss, New Mexico, may have been secured either in New Mexico or Texas. I have endeavored to include in the following list only those species and subspecies which certainly have been taken within the present boundaries of New Mexico.

Another difficulty is the frequent duplication of geographical names. Thus, there are two Cimarron rivers, in Union and Colfax counties; two San Mateo mountain ranges, in Valencia and Socorro counties; and various other duplications which may lead to confusion. The present Fort Wingate is in McKinley County, but the old fort was located near San Rafael, in Valencia County.

List of the Amphibians and Reptiles of New Mexico

1. Ambystoma tigrinum
2. Eurycea multiplicata
3. Scaphiopus hammondii
4. Scaphiopus couchii
5. Bufo punctatus
6. Bufo debilis
7. Bufo compactilis
8. Bufo cognatus cognatus
9. Bufo woodhousii
10. Acris gryllus
11. Pseudacris triseriata
12. Hyla arenicolor
13. Hyla eximia
14. Rana pipiens
15. Coleonyx variegatus
16. Crotaphytus collaris collaris
17. Crotaphytus collaris baileyi
18. Crotaphytus wislizenii
19. Callisaurus ventralis ventralis
20. Holbrookia texana
    (Holbrookia maculata maculata)
21. Holbrookia maculata approximans
22. Uta levis
23. Uta ornata ornata
24. Uta stansburiana elegans
25. Sceloporus graciosus graciosus
26. Sceloporus consobrinus
27. Sceloporus magister
28. Sceloporus torquatus poinsettii
29. Sceloporus jarrovii
30. Sceloporus clarkii
31. Sceloporus spinosus floridanus
32. Phrynosoma douglassii ornatissimum
33. Phrynosoma douglassii hernandesi
34. Phrynosoma cornutum
35. Phrynosoma modestum
36. Ophisaurus ventralis
37. Gerrhonotus kingii

38. Heloderma suspectum
39. Cnemidophorus perplexus
40. Cnemidophorus sexlineatus ?
41. Cnemidophorus gularis
42. Cnemidophorus grahamii
43. Cnemidophorus tessellatus tessellatus
44. Eumeces obsoletus
45. Eumeces guttulatus
46. Eumeces multivirgatus
47. Leptotyphlops dulcis
48. Diadophis regalis
49. Heterodon nasicus
50. Liopeltis vernalis
51. Opheodrys aestivus
52. Coluber constrictor flaviventris
53. Coluber flagellum flagellum
54. Coluber flagellum piceus
55. Coluber tæniatus tæniatus
56. Salvadora grahamiæ
57. Elaphe læta
58. Arizona elegans
59. Pituophis sayi
(Pituophis catenifer rutilus)
60. Lampropeltis triangulum gentilis
61. Lampropeltis pyromelana
62. Lampropeltis getulus splendida
63. Rhinocheilus lecontei
64. Ficimia cana
65. Hypsiglena ochrorhynchus ochrorhynchus
66. Natrix sipedon transversa
67. Thamnophis sirtalis parietalis
68. Thamnophis eques
69. Thamnophis ordinoides vagrans
70. Thamnophis marcianus
71. Thamnophis megalops
72. Thamnophis radix
73. Thamnophis proximus
74. Thamnophis angustirostris
75. Sonora semiannulata
76. Tantilla nigriceps

77. Micrurus euryxanthus
78. Sistrurus catenatus edwardsii
79. Crotalus molossus
80. Crotalus atrox
81. Crotalus confluentus
82. Crotalus lepidus
83. Crotalus pricei
84. Kinosternon sonoriense
85. Kinosternon flavescens
86. Pseudemys elegans
87. Chrysemys marginata bellii
88. Terrapene ornata

1. **Ambystoma tigrinum** (Green)

Tiger Salamander

Ambystoma mavortia Baird, Journn. Acad. Nat. Sci. Phila., Ser. 2, Vol. 1, 1849, pp. 284, 292 (type locality, New Mexico).

Ambystoma mavortium Hallowell, Journ. Acad. Nat. Sci. Phila., Ser. 2, Vol. III, 1858, p. 352.

Amblystoma trisruptum Cope, Proc. Acad. Nat. Sci. Phila., 1867, p. 194 (type locality, Ocate Creek, New Mexico); Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 150; Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 86.

Amblystoma mavortium Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 516; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 631; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 149; Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 14.

Amblystoma tigrinum trisruptum Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 37.

Amblystoma tigrinum Cope, Bull. U. S. Nat. Mus., No. 34, 1889, pp. 84, 85; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326.

Ambystoma tigrinum Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Ellis and Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

Ambystoma trisruptum Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 12.

This salamander has been collected in McKinley (Nutrias, Fort Wingate), Sandoval (Jamez Mountains), Santa Fe (Santa Fe Creek, Santa Fe), Mora (Ocate Creek on east side of the Sangre de Cristo Mountains, Fort Union), Bernalillo (Albuquerque), Torrance (Stinking Spring Lake), Lincoln (Capitan Mountains, Ancho), Dona Ana (Las Cruces, Fort Thorn) counties, and on the Rio Nimbres, and at Jacob's Well nearly on the Arizona boundary, and near Pescao.

2. **Eurycea multiplicata** (Cope)

Many-ribbed Triton

Spelerpes multiplicatus Bailey, N. Amer. Fauna, No. 35, 1913, p. 35.
Eurycea multiplicata Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 20; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 17.

One specimen collected by Prof. Junius Henderson in the Jamez Mountains, Sandoval County, is No.42,921 of the National Museum collection.

3. **Scaphiopus hammondii** Baird

Western Spadefoot

Spea stagnalis Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 525; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 177; Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 46.
Spea hammondi Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 630.
? *Scaphiopus* sp. Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 10.
Spea hammondii Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 14.
Spea hammondii hammondii Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 306.
Scaphiopus hammondii Dickerson, Frog Book, 1906, p. 59; Ellis and Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.
Scaphiopus hammondi Stone, Proc. Acad. Nat. Sci. Phila., 1911, p. 223; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35.
Scaphiopus hammondi bombifrons Bailey, N. Amer. Fauna, No. 35, 1913, p. 35.

This species has been taken in McKinley (Fort Wingate), Santa Fe (Santa Fe), Bernalillo (Albuquerque), Hidalgo (Monument 66), Otero (Alamogordo), and perhaps Sierra (Lake Valley) counties, and at Alto dos Utas.

Cope states that it was abundant near Santa Fe in July and August, when it deposits its eggs in pools of rain water. Cope also "found this species in temporary pools of rain water on the Eocene plateau of Northwest New Mexico, thirty miles from the nearest spring, and forty miles or more from running water. It is usually found in such localities, where it passes through its metamorphoses with great rapidity. As in other species of the group, the tadpoles reach a rather large size before the changes are completed. After these are effected, the frog remains in the pools as long as possible, swimming rather feebly from place to place when disturbed. As in other Batrachians inhabiting similar situations, their existence is entirely dependent on the temporary pools remaining after rains, and their metamorphosis is necessarily rapid and subject to many vicissitudes"

4. **Scaphiopus couchii** Baird

Sonoran Spadefoot

? *Scaphiopus* sp. Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 10.
Scaphiopus couchii Stone, Proc. Acad. Nat. Sci. Phila., 1911, p. 223.

The presence of this species in Hidalgo County is indicated by Stone's record of three specimens collected by Dr. H. A. Pilsbry on the mesa east of the Big Hatchet Mountains. Cope's young spadefoot from Lake Valley, Sierra County, may have belonged either to this or the preceding species.

5. **Bufo punctatus** Baird

Spotted Toad

Bufo punctatus Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 162; Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 264; Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 34; Ruthven, Bull. Amer. Mus. Nat., Hist., Vol. XXIII, Art. XXIII, 1907, p. 507; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Ellis & Henderson, Univ. Colorado Bulletin, Vol. XV, No. 6, 1915, p. 225.

Yarrow and Cope recorded this toad from the Rio San Pedro, New Mexico. This record may relate to the river of that name in what is now Arizona. Stone and Rehn mention two specimens taken at about 4,600 to 5,000 feet altitude in Dry Canyon, Otero County. Ruthven found one on the streets of Alamogordo, Otero County. The National Museum has specimens from Dog Spring and Dog Mountains, Hidalgo County.

6. **Bufo debilis** Girard

Dwarf Toad

I have found no published records of this species in New Mexico. The National Museum has specimens so identified from Cuervo, Guadalupe County, and the Hatchet Ranch.

7. **Bufo compactilis** Wiegmann

Sonoran Toad

Bufo speciosus Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 164.

Bufo lentiginosus speciosus Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 43.

Bufo compactilis Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 273; Dickerson, Frog Book, 1906, p. 102; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 28; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 25.

This toad has been recorded by Yarrow and Cope as taken at "Fort Bliss, New Mexico." Fort Bliss is in Texas a few miles from Dona Ana and Otero counties, New Mexico. The National Museum has specimens from Albuquerque, Bernalillo County, and from the Mimbres Mountains, between Sierra and Grant counties.

8. **Bufo cognatus cognatus** (Say)

Great Plains Toad

Bufo cognatus Bailey, N. Amer. Fauna, No. 35, 1913, p. 35.

The National Museum has this species from Monument 66 of the Mexican boundary and from Albuquerque, Bernalillo County.

9. **Bufo woodhousii** Girard

Rocky Mountain Toad

Bufo frontosus Cope, Proc. Acad. Nat. Sci. Phila., 1866, p. 301 (type locality, Los Pinos, Rio Grande, New Mexico.)

Bufo lentiginosus frontosus Cope, Bull. U. S. Nat. Mus., No. 1, 1875, p. 29; Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 520; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 627; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 165; Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 42.

Bufo lentiginosus woodhousei Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 521; Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 284; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Dickerson, Frog Book, 1906, p. 91.

Bufo lentiginosus americanus Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 166.

Bufo lentiginosus dorsalis Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 43.

Bufo lentiginosus woodhousii Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 507.

Bufo woodhousii Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

This species has been collected at Cantonment Burgwyn, Nutria, Plaza del Alcalde, Los Pinos on the Rio Grande, and in Taos (Taos), McKinley (Fort Wingate), Valencia (Mount Sedgwick), Santa Fe (Santa Fe), Bernalillo (Albuquerque), Lincoln (Capitan Mountains), Grant (Red Rock), Dona Ana (Las Cruces), and Otero (Alamogordo, Mescalero), counties.

10. **Acris gryllus** (Le Conte)

Cricket Frog

Acris gryllus crepitans Ellis, Copeia, 1917, No. 43, p. 39.

Ellis found this species common along North Spring, South Spring and Berrendo rivers, near Roswell, and near Sulphur Spring, Pecos Hills, eighteen miles east of Roswell, Chaves County.

11. **Pseudacris triseriata** (Wied)

Western Marsh Toad

Chorophilus triseriatus Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 347; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

Pseudacris triseriata Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 31; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 29.

This little frog was recorded by Cope from Fort Union, Mora County.

12. **Hyla arenicolor** Cope
Sonoran Tree-toad

Hyla arenicolor Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 524; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 175; Cope, Bull. U. S. Nat. Mus., No. 34, 1889, p. 370; Dickerson, Frog Book, 1906, p. 122; Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 509; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

Hyla arenicolor has been collected in McKinley (Fort Wingate), Santa Fe (Santa Fe), and Hidalgo (Animas Mountains) counties.

13. **Hyla eximia** Baird
Mexican Tree-toad

Hyla eximia Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 524; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 172; Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 45; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 33; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 30.

Yarrow recorded this tree-toad as collected at Nutria, in the Zuñi Indian Reservation, McKinley County, and at Santa Fe, Santa Fe County. The specimens are still in the National Museum.

14. **Rana pipiens** Schreber
Leopard Frog

Rana halecina Cope, Proc. Acad. Nat. Sci. Phila., Vol. XVIII, 1866, p. 301; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 631; Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 10.

Rana halecina berlandieri Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 526; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 180.

Rana halecina halecina Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 179.

Rana virescens brachycephala Cope, Bull. U. S. Nat. Mus., No. 34, 1889, pp. 405, 406; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326.

Rana pipiens Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; Ellis, Copeia, No. 43, 1917, p. 39.

The only true frog found in New Mexico is this widely distributed species. It has been collected in San Juan (San Juan River), Rio Arriba (Abiquiu, Lake Burford), Taos (Taos), Mora (Fort Union), McKinley (Rio Gallo near Fort Wingate, Zuñi River, Nutria, Zuñi City), Santa Fe (Santa Fe), Bernalillo (Albuquerque), Guadalupe (Santa Rosa), Sierra (Lake Valley), Dona Ana (Las Cruces), Otero (Mescalero), and Chaves (near Roswell) counties, and near Plaza del Alcade.

15. **Coleonyx variegatus** (Baird)
Banded Gecko

Coleonyx brevis Ruthven, Bull. Amer. Mus. Nat. Sci. Hist., Vol. XXIII, Art. XXIII, 1907, p. 552; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

Eublepharis variegatus Ditmars, Reptile Book, 1907, p. 26.

Coleonyx variegatus Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 43.

The only New Mexican record seems to be of a specimen from Alamogordo, Otero County, identified by Ruthven as *C. brevis*. Stejneger and Barbour, however, include New Mexico in the range of *C. variegatus*, limiting *C. brevis* to Texas.

16. **Crotaphytus collaris collaris** (Say)
Eastern Collared Lizard

Crotaphytus collaris Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 52 (part); Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 16; Stejneger, N. Amer. Fauna, No. 3, 1890, p. 104; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 248, fig. 19 (part); Bailey, N. Amer. Fauna, No. 35, 1913, p. 34.

Crotaphytus collaris collaris Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 45; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 43.

Specimens from eastern New Mexico were referred to this subspecies by Stejneger. The National Museum has specimens from Mora (Fort Union) and San Miguel (thirty miles northwest of Tecumari) counties.

17. **Crotaphytus collaris baileyi** (Stejneger)
Bailey's Collared Lizard

Crotaphytus collaris Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 565; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 598; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 52 (part); Cope, Proc. Acad. Nat. Sci. Phila., 1883, pp. 10, 12; Cope, Bull. U. S. Nat. Mus. for 1898, 1900, p. 248, fig. 19 (part); Brown, Proc. Acad. Nat. Sci. Phila., 1903, p. 548.

Crotaphytus reticulatus Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 567.

Crotaphytus baileyi Stejneger, N. Amer. Fauna, No. 3, 1890, p. 103; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 327.

Crotophytus Collaris Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 141, pls. XXII, XXIII.

Crotaphytus collaris baileyi Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 30; Bailey, N. Amer. Fauna, No. 25, 1905, p. 40; Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 512; Bailey, N. Amer. Fauna, No. 35, 1913, p. 34; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 45; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 104; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 44.

This lizard has been collected in San Juan, McKinley (Fort Wingate, Gallup), Santa Fe (Santa Fe, San Ildefonso), Bernalillo (Albuquerque), Socorro (Socorro, ten miles east of Socorro), Sierra (Lake Valley), Luna (eight miles east of Deming), Dona Ana (Las Cruces, Organ City), Otero (plains near Alamogordo, foothills of the Sacramento Mountains, Dry Canyon at 4,600 to 5,000 feet, White Sands), and Eddy (east base of the Guadalupe Mountains west of Carlsbad) counties, and at Agua Azul, Parker's Well, and the Rio Grande at Los Pinos.

18. **Crotaphytus wislizenii** Baird & Girard
Leopard Lizard

Crotaphytus wislizenii Baird & Girard, Proc. Acad. Nat. Sci. Phila., Vol. VI, 1852, p. 69 (type locality, Santa Fe); Baird & Girard, Stansbury's Exped. Great Salt Lake, 1853, p. 340, pl. III; Hallowell, Sitgreaves' Exped. Zuñi and Colorado Rivers, 1853, p. 145; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 53; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 327; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 255, fig. 21 (part); Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 31; Ditmars, Reptile Book, 1907, p. 115; Ruthven, Bull. Amer. Mus.

Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 515; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 116; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 45.

Crotaphytus fasciatus Hallowell, Proc. Acad. Nat. Sci. Phila., 1852, p. 206 (type locality, **Jornado del Muerte, New Mexico**); Hallowell, Sitgreaves' Exped. Zuñi and Colorado Rivers, 1853, p. 115, pl. V.

Crotophytus Wislizenii Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 140.

The Leopard Lizard has been taken in Santa Fe (Santa Fe), Bernalillo (Albuquerque), Valencia (Laguna), Grant (seven miles southwest of Hachita), Luna (Deming), Dona Ana (Las Cruces, Dona Ana, Jornado del Muerte), and Otero (plains near Alamogordo) counties, and at Pelman's Well.

19. **Callisaurus ventralis ventralis** (Hallowell)
Desert Gridiron-tailed Lizard

Homalosaurus ventralis Hallowell, Proc. Acad. Nat. Sci. Phila., Vol. VI, 1852, p. 159 (type locality, **New Mexico**); Hallowell, Sitgreaves' Exped. Zuñi and Colorado Rivers, 1853, p. 117, pl. 6.

Callisaurus ventralis ventralis Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 47; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 152; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 47.

That this lizard ever has been taken within the present limits of New Mexico is doubtful. The only record seems to be of the type specimen taken in New Mexico west of the Rio Grande. This specimen may have come from what is now Arizona. However, there is no evident reason why this lizard should not occur in New Mexico for it is common in Cochise County, Arizona.

20. **Holbrookia texana** (Troschel)
Band-tailed Earless Lizard

Holbrookia texana Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 564; Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 12; Cragin, Bull. Washburn Lab., Vol. I, 1884, p. 8; Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 122; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 289; Stone &

Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 31; Bailey, N. Amer. Fauna, No. 25, 1905, p. 40; Stone, Proc. Acad. Nat. Sci. Phila., 1911, p. 226; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 49; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 49.

This lizard has been collected in Socorro (Socorro), Grant (Redrock), Sierra (Lake Valley), Guadalupe (Santa Rosa), and Otero (greasewood belt east of Alamogordo, Dry Canyon) counties, and at Parker's Well.

21. **Holbrookia maculata approximans** (Baird)

Western Earless Lizard

Holbrookia propinqua Cope, Proc. Acad. Nat. Sci. Phila., 1866, p. 303; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

Holbrookia maculata maculata Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 563 (part); Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 49 (part); Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 296 (part).

Holbrookia maculata propinqua Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 564; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 601.

Holbrookia maculata Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 601 (part); Cope, Proc. Acad. Nat. Sci. Phila., 1883, pp. 10, 12; Cragin, Bull. Washburn Lab., Vol. I, 1884, p. 8; Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 121; Bailey, N. Amer. Fauna, No. 35, 1913, p. 34; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

Holbrookia maculata flavilenta Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 10 (type locality, **Lake Valley, New Mexico**); Stejneger, N. Amer. Fauna, No. 3, 1890, p. 109; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 298; Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 523; Stone, Proc. Acad. Nat. Sci. Phila., 1911, p. 225; Bailey, N. Amer. Fauna, No. 35, 1913, p. 34; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 48; Schmidt, Bull. Amer. Mus. Nat. Hist., Vol. XLVI, Art. XII, 1922, p. 720; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 48.

Holbrookia maculata approximans Bailey, N. Amer. Fauna, No. 35, 1913, p. 34; Stejneger & Barbour Check List N. Amer. Amph. Rept., 1917, p. 48; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 170; Schmidt, Bull. Amer. Mus. Nat. Hist., Vol. XLVI, Art. XII, 1922, p. 721; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 48.

Holbrookia maculata campi Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 48.

It is probable that *H. maculata maculata* occurs in the northeastern quarter of New Mexico, but the specimens of *Holbrookia* which have been collected (with the exception of those from twenty-five miles west of Tucumcari, Quay County) are from the central and western portions of the state. It seems best to refer all these to the western subspecies, *H. maculata approximans,* at least until they have been re-examined. They have been taken in San Juan (twénty-five miles southeast of Fruitland), Rio Arriba (Abiquiu, Espanola), McKinley (Fort Wingate, Zuñi City, Nutria), Santa Fe (San Ildefonso, Santa Fe), San Miguel (Las Vegas, Cabra Springs at 5,600 feet), Valencia (Lava Beds, Acoma Pueblo), Bernalillo (Albuquerque), Socorro (Socorro, San Augustine Plains near Monica Springs), Lincoln (ten miles north of Capitan Mountains), Grant (Santa Rita del Cobre, Hachita at 4,700 feet), Sierra (Lake Valley, Fair View), Hidalgo (Dog Springs, Long's Ranch in Animas Valley, Playas Valley at 4,800 feet), and Otero (White Sands west of Alamogordo, greasewood plains east of Alamogordo) counties, and at Plaza del Alcalde and Parker's Well.

22. **Uta levis** Stejneger
Rocky Mountain Tree Uta

?*Uta symmetrica* COPE, Proc. Acad. Nat. Sci. Phila., 1866, p. 303.

? *Uta stansburiana* YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 568 (part).

Uta ornata YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 56 (part); ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

Uta levis STEJNEGER, N. Amer. Fauna No. 3, 1890, p. 108 (footnote) (type locality, **Tierra Amarilla, New Mexico**); COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 314; DITMARS, Reptile Book, 1907, p. 124; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 50; SCHMIDT, Amer. Mus. Novitates, No. 22, 1921, p. 6; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 208; STEJNEGER & BARBOUR, Check List N. Amer. Amp. Rept., Ed. 2, 1923, p. 51.

Uta levis was described from two speciments taken at Tierra Amarilla, Rio Arriba County. Cope's record of *Uta symmetrica* from Bero Springs, near Fort Wingate, McKinley County, probably belongs here.

23. **Uta ornata ornata** (Baird & Girard)

Texas Tree Uta

Uta schotti COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 10.

Uta gratiosa BOULENGER, Cat. Lizards Brit. Mus., Vol. II, 1885, p. 213 (part)

Uta ornata HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 138; DITMARS, Reptile Book, 1907, p. 124; STONE, Proc. Acad. Nat. Sci. Phila., 1911, p. 226; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34.

Uta ornata ornata SCHMIDT, Amer. Mus. Novitates, No. 22, 1921, p. 6.

This lizard probably occurs throughout southern New Mexico, but has been recorded only from Socorro (Luna), Sierra (Lake Valley), Luna (north side of the Florida Mountains), and Otero (greasewood belt east of Alamogordo) counties.

24. **Uta stansburiana elegans** (Yarrow)

Southern Brown-shouldered Uta

Uta stansburiana YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 568 (part?); COUES, Surv. W. 100th Merid., Vol. V, 1875, p. 596; YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 56; COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 12; CRAGIN, Bull. Washburn Lab., Vol. I, 1884, p. 7; COCKERELL, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 310; RUTHVEN, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 526; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

Uta elegans BOULENGER, Cat. Lizards Brit. Mus., Vol. II, 1885, p. 211.

Uta Stanisburiana HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 138, pl. XXI.

Uta stansburyana STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, p. 31; STONE, Proc. Acad. Nat. Sci. Phila., 1911, p. 226 (part).

Uta stansburiana elegans STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 52; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 240.

Uta stansburiana stejnegeri SCHMIDT, Amer. Mus. Novitates, No. 15, 1921, p. 2 (type locality, **Mouth of Dry Canyon, Alamogordo, Otero County, New Mexico**); SCHMIDT, Amer. Mus. Novitates, No. 22, 1921, p. 5; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 53.

This *Uta* has been taken in San Juan (thirty miles southeast of Fruitland), Santa Fe (San Ildefonso), Bernalillo

(Albuquerque), Socorro (Socorro), Luna (Deming), Dona Ana (Las Cruces), and Otero (Alamogordo, Dry Canyon near Alamogordo) counties.

25. **Sceloporus graciosus graciosus** (Baird & Girard)
Sage-brush Swift

Sceloporus gratiosus Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 576; Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 130.

Sceloporus consobrinus gratiosus Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 62.

Sceloporus graciosus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 389; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

The only published locality for this species in New Mexico seems to be Abiquiu, Rio Arriba County. The National Museum has it from Tierra Amarilla, in the same county.

26. **Sceloporus consobrinus** Baird & Girard
Striped Swift

Sceloporus tristichus Cope in Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 571 (type locality, **Taos, New Mexico**); Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 62; Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 18.

Sceloporus consobrinus Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 574; Yarrow & Henshaw, Ann. Rep. Chief of Engineers for 1878, Surv. W. 100th Merid., Appendix NN, 1878, p. 224 (part); Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 61; Boulenger, Proc. Zool. Soc. London, 1897, p. 486; Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 128; Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 31; Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 539; Bailey, N. Amer. Fauna, No. 35, 1913, pp. 20, 34; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 290.

Sceloporus Occidentalis Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 127, pl. XVII.

Sceloporus undulatus tristichus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 376.

Sceloporus undulatus consobrinus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 380.

Specimens of this lizard have been taken in San Juan (San Juan River), Taos (Taos, Amizett at 8,350 feet), McKinley (Fort Wingate), Santa Fe (Santa Fe), San Miguel (Pecos), Bernalillo (Albuquerque), Torrance (Stinking Spring Lake at 7,600 feet), Socorro (Rio Grande Valley near Socorro), Grant (Burro Mountains at 6,500 feet, Santa Rita, Hachita at 4,700 feet), Hidalgo (Animas Mountains), Luna (Deming), Otero (Alamogordo, Dry Canyon near Alamogordo, Highrolls Sacramento Mountains, Mescalero), counties, and at San Luis, Cantonment Burgwyn, Pescao, Indian Butte, San Mateo Mountains at 8,000 feet, and in the Gila National Forest.

27. **Sceloporus magister** Hallowell

Desert Scaly Lizard

Sceloporus magister COCKERELL, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 125, pl. XVI; RUTHVEN, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 532; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 329.

Sceloporus clarkii COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 361 (part); STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, p. 31 (?).

Specimens from Las Cruces, Dona Ana County, and Alamogordo, Otero County, have been identified by Stejneger and Ruthven. The National Museum has this lizard from the Socorro Mountains, Socorro County.

28. **Sceloporus torquatus poinsettii** (Baird & Girard)

Mexican Scaly Lizard

Sceloporus poinsettii COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 12; HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 123, pl. XV.

Sceloporus torquatus poinsettii COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 353; DITMARS, Reptile Book, 1907, p. 140; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 326.

Sceloporus poinsetti BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34.

This lizard has been taken in Socorro (western part of the Magdalena Mountains at 6,500 feet, Socorro), Lincoln

(Forks of Ruidoso Creek), Grant (Santa Rita del Cobre, Hachita), Sierra (Chloride, Grafton), and Otero (Alamogordo) counties.

29. **Sceloporus jarrovii** Cope
Yarrow's Scaly Lizard

Sceloporus jarrovi Bailey, N. Amer. Fauna, No. 35, 1913, p. 34.

The National Museum has specimens from 5,000 and 6,100 feet on Animas Peak and from the Big Hatchet Mountains, Hidalgo County.

30. **Sceloporus clarkii** Baird & Girard
Arizona Scaly Lizard

Sceloporus clarkii Yarrow & Henshaw, Ann. Rep. Chief of Engineers for 1878, Surv. W. 100th Merid., Appendix NN, 1878, p. 223; Herrick Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 126; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 361 (part); Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 31 (part?); Ditmars, Reptile Book, 1907, p. 131; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 53; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 359; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 54.

Sceloporus clarki clarki Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 63.
Sceloporus clarki Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

This species has been recorded from Fort Craig, Socorro County, and Alamogordo, Otero County. In the National Museum are specimens, so identified, from Pleasanton, Socorro County, Red Rock, Grant County, and Deer Creek, Culberson Ranch at 5,000 feet.

31. **Sceloporus spinosus floridanus** (Baird)
Baird's Scaly Lizard

Sceloporus spinosus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 367.

Sceloporus spinosus floridanus Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 56; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 58.

Cope recorded this lizard from "Fort Bliss, New Mexico," (=Texas). The National Museum has it from 9,000 feet in the Capitan Mountains, Lincoln County.

32. **Phrynosoma douglassii ornatissimum** (Girard)

Eastern Short-horned Horned Toad

Tapaya ornatissima GIRARD, U. S. Explor. Exped., Herpetology, 1858, p. 396 (type locality, **Mountainous region of New Mexico**).

Phrynosoma douglassii douglassii YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 580.

Phrynosomo douglassi ornatissimum YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 581; YARROW, Bull. U. S. Nat. Mus., No 24, 1883, p. 69.

Phrynosoma douglassi COUES, Surv. W. 100th Merid., Vol. V, 1875, p. 591 (part).

? *Phrynosoma regale* YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 66 (part).

Phrynosoma douglassi douglassi YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 68.

Phrynosoma hernandezi YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 68.

Phrynosoma douglassii HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 134, pl. XVIII.

Phrynosoma douglassii hernandesi COPE, Report U. S. Nat. Mus. for 1898, 1900, pp. 414, 415 (part).

Phrynosoma douglassii ornatissimum COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 417; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 377; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 62.

Phrynosoma ornatissimum BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 60.

The short-horned horned toads of New Mexico should be re-examined to make certain their identity. It seems probable that to do this subspecies should be referred those which have been collected in Rio Arriba (Abiquiu, Espanola), Taos (Rio Colorado, Taos), Colfax (Cimarron), Mora (Fort Union), McKinley (Fort Wingate, Zuñi River), Santa Fe (Santa Fe), San Ildefonso), San Miguel (between Anton Chico and Cuesta, Sapello Canyon), Valencia (McCarty's, Lava Beds, Mount Sedgwick), Bernalillo (between San Domingo and Albuquerque, twenty miles east of Albuquerque) counties.

33. **Phrynosoma douglassii hernandsi** (Girard)
Arizona Short-horned Horned Toad

Tapaya hernandesi GIRARD, U. S. Explor. Exped., Herpetology, 1858, p. 395 (type locality, **New Mexico**).

Phrynosoma douglassi COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 12.

Phrynosoma hernandezii COCKERELL, Amer. Naturalist, Vol. XXX, April 1896, p. 327; STONE, Proc. Acad. Nat. Sci. Phila., 1911, p. 229.

Phrynosoma douglassii hernandesi COPE, Report U. S. Nat. Mus. for 1898, 1900, pp. 414, 415 (part); STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, p. 32; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 382; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 61.

Phrynosoma hernandesi RUTHVEN, Bull, Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 542; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; BAILEY, N. Amer. Fauna, No. 35, 1913, pp. 34, 45; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 59.

Specimens referred to this subspecies have been taken in Santa Fe (Lamy, Santa Fe), San Miguel (Sapello Canyon), Bernalillo (Whitecombs Springs, twenty miles east of Albuquerque), Socorro (San Mateo Peak at 9,500 feet, Quemado, Socorro), Lincoln (Capitan Mountains, White Mountain), Grant (Silver City, Mimbres Mountains), Sierra (Grafton), and Otero (Mescalera, Cloudcroft, Transition and Canadian zones of the Sacramento Mountains) counties.

34. **Phrynosoma cornutum** (Harlan)
Texas Horned Toad

Phrynosoma cornutum YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 579; YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 66; COPE, Proc. Acad. Nat. Sci. Phila., 1883, pp. 10, 12; COCKERELL, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; HERRICK, TERRY & HERRICK, Bull, Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 135, pl. XIX; COPE, Report U. S. Nat. Mus. for 1898, 1900, pp. 435, 436 (part); STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, p. 32; DITMARS, Reptile Book, 1907, p. 153; RUTHVEN, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 547; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 58; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 409; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 61.

There are records of this horned toad from Rio Arriba (Abiquiu), Taos (Taos), Mora (Fort Union), Santa Fe (Santa Fe, Ildefonso), Socorro (Socorro, San Marcial), Sierra (Lake Valley), Grant (Hachita), Hidalgo (Animas Valley), Dona Ana (Fort Thorn, Las Cruces, east side of Organ Pass), and Otero (Alamogordo) counties, and the San Pedro Mountains at 7,000 feet.

35. **Phrynosoma modestum** Girard

Round-tailed Horned Toad

Phrynosoma modestum Cope, Proc. Acad. Nat. Sci. Phila., 1866, p. 302; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 594; Yarrow, Bull U. S. Nat. Mus., No. 24, 1883, p. 64; Cope, Proc. Acad. Nat. Sci. Phila., 1883, pp. 10, 12; Cragin, Bull. Washburn Lab., Vol. I, 1884, p. 6; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 327; Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 32; Ditmars, Reptile Book, 1907, p. 156; Stone, Proc. Acad. Nat. Sci. Phila., 1911, p. 229; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 430.

Phrynosoma Platyrhynus Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 136, pl. XX.

Anota modesta Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 439; Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 550; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

This species has been secured in Santa Fe (San Ildefonso), San Miguel (between Anton Chico and Cuesta), Bernalillo (Albuquerque), Socorro (Socorro), Sierra (Lake Valley), Dona Ana (Las Cruces), and Otero (Alamogordo) counties, and at Sheridan Canyon in the Hachita Mountains and Bero Springs.

36. **Ophisaurus ventralis** (Linné)

Glass-tailed Lizard

Ophisaurus ventralis Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 46; Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 14; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 500; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 60; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 64.

Yarrow and Cope record this footless lizard as taken "between Arkansas River and Cimmaron River, New Mexico." The specimen may have come from New Mexico, either in Union or Colfax counties, but it more probably was taken in the area which later became part of Colorado.

37. **Gerrhonotus kingii** (Gray)
Sonoran Alligator Lizard

Elgaria nobilis Baird & Gerard, Proc. Acad. Nat. Sci. Phila., Vol.VI, 1852, p. 129 (type locality, **Fort Webster, copper mines of the Gila — Santa Rita del Cobre—New Mexico**).

Gerrhonotus nobilis Baird, U. S.-Mex. Bound. Surv., Vol. II, 1859, p. 11, pl. XXV, figs. 1-8; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 602; Bailey, N. Amer. Fauna, No. 35, 1913, p. 34; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 61; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 65.

Gerrhonotus kingii Boulenger, Cat. Lizards Brit. Mus., Vol. II, 1885, p. 274; Ditmars, Reptile Book, 1907, p. 164; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 461.

Gerrhonotus knightii Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 143.

This lizard has been taken in the southwestern counties: Grant (Santa Rita del Cobre), Sierra (Grafton), Hidalgo (Animas Peak, Animas Mountains), and Luna (Deming).

38. **Heloderma suspectum** Cope
Gila Monster

Heloderma suspectum Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 562; Boulenger, Cat. Lizards Brit. Mus., Vol. II, 1885, p. 302; Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 144; Cope, Report U. S. Nat. Mus. for 1898, 1900, pp. 476, 483; Ditmars, Reptile Book, 1907, p. 172; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

Although this lizard has been credited to New Mexico many times, there seem to be no definite locality records and no specimens from the state.

39. **Cnemidophorus perplexus** Baird & Girard
Seven-lined Whiptail Lizard

Cnemidophorus octo-lineatus Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 558.

Cnemidophorus perplexus YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 44; GARMAN, Bull. Essex Inst., Vol. XVI, 1884, p. 13; COCKERELL, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; COPE, Report U. S. Nat Mus. for 1898, 1900, p. 574; GADOW, Proc. Zool. Soc. London, 1906, p. 368;

STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 67; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 495; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 72.

This lizard has been collected in Santa Fe (San Ildefonso) and Dona Ana (Las Cruces) counties.

40. **Cnemidophorus sexlineatus** (Linné)
Eastern Whiptail Lizard

Cnemidophorus sexlineatus RUTHVEN, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 570; STONE, Proc. Acad. Nat. Sci. Phila., 1911, p. 230; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

I suspect that the specimens from Alamogordo, recorded by Ruthven and Stone as *C. sexlineatus*, should be referred to *C. perplexus*. At any rate, they should be re-examined.

41. **Cnemidophorus gularis** Baird & Girard
Sonoran Whiptail Lizard

Cnemidophorus sexlineatus gularis COPE, Proc. Acad. Nat. Sci. Phila., 1866, p. 303.

Cnemidophorus sex-lineatus YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 557 (part); YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 43; COPE, Proc. Acad. Nat. Sci. Phila., 1883, pp. 11, 12; HERRICK, TERRY & HERRICK, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mex., Vol. I, 1899, p. 145, pl. XXIV, figs. 23, 24; COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 597 (part).

Cnemidophorus gularis gularis COPE, Report U. S. Nat. Mus. for 1898, 1900, pp. 603, 604.

Cnemidophorus gularis STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, p. 32; BROWN, Proc. Acad. Nat. Sci. Phila., 1903, p. 548; GADOW, Proc. Zool. Soc. London, 1906, pp. 305, 330; RUTHVEN, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 556; DITMARS, Reptile Book, 1907, p. 187; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20; VAN DENBURGH, Occas. Papers, Cal. Acad. Sci., X, 1922, p. 499.

This whiptail lizard has been collected in Rio Arriba (Abiquiu, Rinconada, at 5,600 feet), McKinley (Fort Wingate), Santa Fe (Santa Fe), Bernalillo (Albuquerque), Socorro (Socorro), Lincoln (Ancho at 6,150 feet), Grant (Silver City, Hachita), Sierra (Lake Valley), Hidalgo (Playas Valley at 3,400 feet, Animas Valley at 5,100 feet), and Otero (Alamogordo, Dry Canyon) counties, and at Plaza del Alcalde.

42. **Cnemidophorus grahamii** Baird & Girard
Texas Whiptail Lizard

Cnemidophorus grahami Bailey, N. Amer. Fauna, No. 35, 1913, p. 34.

I have examined a specimen collected fifteen miles north of Las Cruces, Dona Ana County. It is preserved in the collection of the Museum of Comparative Zoology.

43. **Cnemidophorus tessellatus tessellatus** (Say)
Desert Whiptail Lizard

Cnemidophorus tessellatus Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 33; Brown, Proc. Acad. Nat. Sci. Phila., 1903, p. 548; Gadow, Proc. Zool. Soc. London, 1906, p. 369; Ditmars, Reptile Book, 1907, p. 186; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119.

Cnemidophorus Undulatus Herrick, Terry & Herrick, Bull. Sci. Lab. Denison Univ., Vol. XI, 1899, and Bull. Univ. New Mexico, Vol. I, 1899, p. 146.

Cnemidophorus tessellatus tessellatus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 580.

? *Cnemidophorus melanostethus* Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 560; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

Cnemidophorus tigris Stone, Proc. Acad. Nat. Sci. Phila., 1911, p. 230; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

This lizard has been found in Rio Arriba (Espanola at 5,000 feet), Bernalillo (Albuquerque), Luna (Deming), Dona Ana (Las Cruces, fifteen miles north of Las Cruces), and Otero (Alamogordo) counties.

44. **Eumeces obsoletus** (Baird & Girard)

Sonoran Skink

Eumeces obsoletus YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 556; COUES, Surv. W. 100th Merid., Vol. V, 1875, p. 604; COCKERELL, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 646; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34.

Plestiodon obsoletus VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 589.

Coues found this species among aquatic plants of a pool at Bero Springs between Fort Wingate and Santa Fe. Cockerell states that it is not rare near the college at Las Cruces, Dona Ana County. The National Museum has it from Las Cruces and from Valencia (Grant's) and Bernalillo (Albuquerque) counties.

45. **Eumeces guttulatus** (Hallowell)

White-spotted Skink

Lamprosaurus guttulatus HALLOWELL, Proc. Acad. Nat. Sci. Phila., Vol. VI, 1852, p. 206 (type locality, **Fort Fillmore below Jornado del Muerte, New Mexico**).

Plestiodon guttulatus HALLOWELL, Proc. Acad. Nat. Sci. Phila., 1857, p. 215; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 594.

Eumeces guttulatus COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 646; DITMARS, Reptile Book, 1907, p. 200; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 119; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 75.

This skink seems to have been taken only in Dona Ana County, the definite records being Fort Fillmore and Las Cruces.

46. **Eumeces multivirgatus** (Hallowell)

Prairie Skink

Eumeces multivirgatus BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34; STRECKER, Baylor Bulletin, Vol. XVIII, No. 4, 1915, p. 26.

Specimens so identified, in the National Museum, were collected at Fort Wingate and at "Top of Ridge, Forks of Rindosa." Strecker records a specimen taken in New Mexico only a short distance from the Texas line.

47. **Leptotyphlops dulcis** (Baird & Girard)

Eastern Worm-snake

Stenostoma dulce Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 11.

Leptotyphlops dulcis Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 72; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 628; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 79.

Glauconia dissecta Cope, Amer. Naturalist, Vol. XXX, 1896, p. 753 (type locality, Silver Mines at Lake Valley, southern New Mexico); Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 716.

Glauconia dulcis Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 718; Brown, Proc. Acad. Nat. Sci. Phila., 1901, p. 13; Ditmars, Reptile Book, 1907, p. 210.

This worm-snake has been collected in Sierra (Silver Mines at Lake Valley) and Dona Ana (Las Cruces, Mesilla Valley, Mesilla Park) counties.

48. **Diadophis regalis** Baird & Girard

Sonoran Ring-necked Snake

Diadophis regalis Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 12; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 76; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 652.

Diadophis regalis regalis Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 745.

The Sonoran Ring-necked Snake has been taken in Socorro (Socorro), Sierra (Lake Valley) and Dona Ana (Las Cruces, Mesilla Valley) counties.

49. **Heterodon nasicus** Baird & Girard
Western Hog-nose Snake

Heterodon nasicus Baird & Girard, Cat. N. Amer. Rept., Pt. I, Serpents, 1853, p. 62; Baird, U. S. Mex. Bound. Surv., Vol. II, 1859, p. 18; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 655.

Heterodon simus nasicus Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 555; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 611; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 140.

Heterodon nasicus nasicus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 777.

The Western Hog-nose Snake has been secured in Rio Arriba (Abiquiu), Santa Fe (Ildefonso, Santa Clara, Santa Fe), Mora (Fort Union), San Miguel (Cabra Spring), Grant (Fort Webster, Santa Rita del Cobre), and Dona Ana (Las Cruces) counties.

50. **Liopeltis vernalis** (Harlan)
Smooth Greensnake

Cyclophis vernalis Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 539; Yarrow, Amer. Naturalist, Vol. X, 1876, p. 494; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 99; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Cope, Report U. S. Nat. Mus. for 1898, 1900, pp. 783, 784.

Liopeltis vernalis Ditmars, Reptile Book, 1907, p. 324; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 77; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 85.

This snake has been taken in Rio Arriba (Valley of the Chama, Abiquiu), Colfax (Moreno Valley, Head of Ponil Creek), Lincoln (Ruidosa at Forks), and Dona Ana (Las Cruces, Mesilla Valley) counties.

51. **Opheodrys aestivus** (Linné)
Rough Greensnake

Cyclophis aestivus Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 100; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 786; Brown, Proc. Acad. Nat. Sci. Phila., 1901, p. 65.

Ophiodrys aestivus Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 78; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 85.

The Rough Greensnake has been recorded from the Cimarron River, New Mexico, and from Fort Bliss, New Mexico. It is doubtful if either record is based upon specimens taken within the present boundaries of the state.

52. **Coluber constrictor flaviventris** (Say)
Yellow-bellied Racer

Bascanium constrictor vetustum Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 541.

? *Bascanicum constrictor* Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 108; Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 12.

Bascanium constrictor flaviventris Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 110.

Zamenis constrictor Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 797.

? *Zamenis constrictor constrictor* Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

Zamenis constrictor flaviventris Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

New Mexican records include Tierra Amarilla, Rio Arriba County; Socorro, Socorro County, and Fort Conrad.

53. **Coluber flagellum flagellum** (Shaw)
Whip Snake

Bascanion flagellum Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

Zamenis flagellum Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

A specimen in the National Museum, collected at Tecumcari, Quay County, may perhaps belong to this subspecies.

54. **Coluber flagellum piceus** (Cope)
Red Racer

Masticophis flavigularis Baird & Girard, Marcy's Explor. Red River, 1853, p. 230.

Bascanium flagelliforme testaceum Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 542; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 111.

Bascanion testaceum Cockerell, Amer. Naturalist, Vol. XXX, 1896, p. 326.

Zamenis flagellum Cope, Report U. S. Nat. Mus. for 1898, 1900, pp. 802, 803.

Bascanion flagellum frenatum Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 575; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35.

Racers which have been collected in Grant (Fort Webster or Copper Mines), Dona Ana (Las Cruces), and Bernalillo (Albuquerque) counties probably represent this subspecies. Yarrow records it from Lajura.

55. **Coluber taeniatus taeniatus** (Hallowell)
Western Striped Racer

Leptophis taeniata Hallowell, Proc. Acad. Nat. Sci. Phila., Vol. VI, 1852, p. 181 (type locality, **New Mexico, west of Rio Grande**).

Bascanium taeniatum laterale Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 543.

Bascanium taeniatum taeniatum Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 112.

Zamenis taeniatus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 817; Ditmars, Reptile Book, 1907, p. 289; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

Bascanion taeniatum Bailey, N. Amer. Fauna, No. 35, 1913, p. 35.

Coluber taeniatus taeniatus Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 80; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 685; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 88.

This racer has been taken in San Juan (Shiprock) and McKinley (Nutria) counties.

56. **Salvadora grahamiae** Baird & Girard
Eastern Patch-nosed Snake

Phimothyra grahami Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 98.

Salvadora grahamiae Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 820; Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 33; Ditmars, Reptile Book, 1907, p. 292; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

? *Salvadora hexalepis* Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

The Patch-nosed Snake has been taken in Guadalupe (Santa Rosa), Socorro (Fort Craig), and Otero (Alamogordo) counties.

57. **Elaphe laeta** (Baird & Girard)
Emory's Pilot Snake

Coluber emoryi Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 101; Cockerell, Amer. Naturalist, Vol. XXX, 1896, p. 326; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 854; Ditmars, Reptile Book, 1907, p. 298.
Elaphe emoryi Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

The only definite record seems to be that, by Cockerell, of a specimen secured near Las Cruces, Dona Ana County. The snake recorded by Yarrow as from Fort Bliss, New Mexico, may have been captured in that state or in Texas.

58. **Arizona elegans** Kennicott
Faded Snake

Pituophis elegans Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 108.
Arizona elegans Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 580; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Van Denburgh, Occas. Papers. Cal. Acad. Sci., X, 1922, p. 702.
Rhinechis elegans Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 865.

The Faded Snake has been recorded as taken in New Mexico between the Arkansas and Cimarron rivers, and at Las Cruces, Dona Ana County.

59. **Pituophis sayi** (Schlegel)
Western Bull Snake

Pituophis bellona Baird & Girard, Cat. N. Amer. Rept., Pt. I, Serpents, 1853, p. 68.
Pityophis sayi mexicanus Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 539.
Pityophis sayi bellona Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 540; Cope, Report U. S. Nat. Mus. for 1898, 1900, pp. 875, 876; Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 33; Ditmars, Reptile Book, 1907, p. 320.
Pityophis sayi sayi Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 105; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 872.
Pituophis sayi Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35.
Pityophis catenifer bellona Brown, Proc. Acad. Nat. Sci. Phila., 1901, p. 54; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

Pituophis catenifer sayi RUTHVEN, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 581; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

Pituophis catenifer deserticola BAILEY, N. Amer. Fauna, No. 35, 1913, p. 35.

The bull snakes or gopher snakes of New Mexico need further study. They usually have been referred to *P. sayi,* but it is possible that they are not identical with the snakes of Missouri and should be referred to a distinct subspecies, *P. sayi affinis* (Hallowell). Also, it may be that *P. catenifer rutilus* occurs in southwestern New Mexico, or *P. c. stejnegeri* in the northwestern corner of the state.

These snakes have been collected in McKinley (Fort Wingate), Sandoval (Bernalillo), Santa Fe (San Ildefonso), Valencia (Tajique), Guadalupe (Anton Chico), Lincoln (Jacarilla Mountains), Grant (Fort Webster, Santa Rita del Cobre, Fort Bayard, Redrock), Dona Ana (Las Cruces), and Otero (Alamogordo) counties, and at Fort Conrad and the Gila River.

60. **Lampropeltis triangulum gentilis** (Baird & Girard)

Western King Snake

Ophibolus doliatus doliatus YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 89.

Lampropeltis pyrrhomelas COCKERELL, Amer. Naturalist, Vol. XXX, 1896, p. 326.

Osceola doliata coccinea COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 898.

Ophibolus pyrrhomelas COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 908.

Lampropeltis pyrrhomelaena celaenops STEJNEGER, Proc. U. S. Nat. Mus., Vol. XXV, 1902, p. 153 (type locality, **Mesilla Valley, New Mexico**).

Ophibolus doliatus ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

Lampropeltis pyrrhomelanus celaenops BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20.

Lampropeltis trigangulum amaurus BAILEY, N. Amer. Fauna, No. 35, 1913, p. 35.

Lampropeltis pyromelaena celaenops STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 89.

Lampropeltis triangulum gentilis BLANCHARD, Bull. U. S. Nat. Mus., No. 114, 1921, p. 165, fig. 72.

This snake has been taken in Mora (Fort Union) and Dona Ana (Mesilla Valley) counties.

61. **Lampropeltis pyromelana** (Cope)
Arizona King Snake

Lampropeltis pyrrhomelanus Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.
Lampropeltis pyrrhomelaena Blanchard, Bull. U. S. Nat. Mus., No. 114, 1921, p. 231, figs. 5, 71.
Lampropeltis pyromelana Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 746.

This king snake is known only from Hidalgo County, where it has been collected in the Big Hatchet Mountains and on Animas Peak.

62. **Lampropeltis getulus splendida** (Baird & Girard)
Sonoran Milk Snake

Lampropeltis splendida Cockerell, Amer. Naturalist, Vol. XXX, 1896, p. 326.
Ophibolus getulus splendidus Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 919.
Lampropeltis getulus splendidus Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.
Lampropeltis getulus splendida Blanchard, Bull. U. S. Nat. Mus., No. 114, 1921, p. 26, figs. 1, 3, 29, 30, 31.

In New Mexico this snake has been taken only in Dona Ana County at Fort Fillmore and in Mesilla Valley.

63. **Rhinocheilus lecontei** Baird & Girard
Long-nosed Snake

Rhinochilus leconteii Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 88.
Rhinocheilus lecontei Cockerell, Amer. Naturalist, Vol. XXX, 1896, p. 326; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 933; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 774.

Although this snake has been recorded as taken at "Fort Bliss, New Mexico," the only certain record from the state is Cockerell's of a specimen secured in Mesilla Valley near Las Cruces, Dona Ana County.

64. **Ficimia cana** (Cope)
Pug-nosed Snake

Gyalopium canum Ruthven, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 587; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.
Ficimia cana Van Denburgh, Occas. Papers Cal. Acad. Sci., X, 1922, p. 777.

The only record is of a specimen which Ruthven found dead on the shore of Lake Walters, at the White Sands, west of Alamogordo. This specimen is in the American Museum of Natural History.

65. **Hypsiglena ochrorhynchus ochrorhynchus** (Cope)
Spotted Night Snake

Hypsiglena ochrorhyncha BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20.

The National Museum has a specimen labeled "New Mexico."

66. **Natrix sipedon transversa** (Hallowell)
Woodhouse's Water Snake

Natrix fasciata transversa BAILEY, N. Amer. Fauna, No. 25, 1905, p. 47.
Natrix transversa BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20.

The National Museum has the specimen recorded by Bailey. It is labeled Carlsbad, Eddy County.

67. **Thamnophis sirtalis parietalis** (Say)
Prairie Garter Snake

Eutaenia ornata YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 553; COUES, Surv. W. 100th Merid., Vol. V, 1875, p. 613; YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 122.
Eutaenia sirtalis sirtalis YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 123.
Eutaenia sirtalis dorsalis YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 124; COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 1077.
Eutaenia sirtalis obscura YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 126.
Thamnophis dorsalis COCKERELL, Amer. Naturalist, Vol. XXX, 1896, p. 326.
Thamnophis sirtalis parietalis RUTHVEN, Bull. U. S. Nat. Mus., No. 61, 1908, p. 166; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 35.
Thamnophis parietalis ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

This snake has been collected in Rio Arriba (Abiquiu), Taos (Taos), Mora (Ocate River), Santa Fe (San Ildefonso), Bernalillo (Albuquerque), and Dona Ana (Mesilla Valley about Las Cruces) counties, and on Pole Creek, and at Los Pinos on the Rio Grande.

68. **Thamnophis eques** (Reuss)
White-bellied Garter Snake

Eutaenia marciana YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 555; YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 118.

Eutaenia cyrtopsis COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 11.

? *Eutaenia ornata* COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 11.

Eutaenia eques collaris COPE, Proc. U. S. Nat. Mus., Vol. XIV, 1892, p. 657; COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 1052.

Eutaenia aurata COPE, Pros. U. S. Nat. Mus., Vol. XIV, 1892, p. 659 (type locality, **Lake Valley, southern New Mexico**).

Eutaenia eques aurata COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 1052.

Eutaenia eques DITMARS, Reptile Book, 1907, p. 230.

Thamnophis eques RUTHVEN, Bull. U. S. Nat. Mus., No. 61, 1908, p. 158; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 35; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 808; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 113.

This garter snake has been secured in Rio Arriba (Rinconada), Santa Fe (San Ildefonso), San Miguel (Ribera), Bernalillo (Albuquerque), and Sierra (Lake Valley) counties, and on the Rio Mimbres.

As Ruthven states, there may well be a difference of opinion regarding the identity of some specimens referred to this name and to *T. s. parietalis*.

69. **Thamnophis ordinoides vagrans** (Baird & Girard)
Wandering Garter Snake

Eutainia vagrans BAIRD & GIRARD, Cat. N. Amer. Rept., Pt. I, Serpents, 1853, p. 36.

Eutaenia vagrans COPE, Proc. Acad. Nat. Sci. Phila., Vol. XVIII, 1866, p. 305; COUES, Surv. W. 100th Merid., Vol. V, 1875, p. 614.

Eutaenia vagrans vagrans YARROW, Surv. W. 100th Merid., Vol. V, 1875, p. 551; YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, pp. 119, 120.

Eutaenia elegans vagrans COPE, Proc. U. S. Nat. Mus., Vol. XIV, 1892, p. 656; COPE, Report U. S. Nat. Mus. for 1898, 1900, pp. 1041, 1042; DITMARS, Reptile Book, 1907, p. 228.

? *Eutaenia elegans marciana* COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 1046.

Thamnophis ordinoides elegans RUTHVEN, Bull. U. S. Nat. Mus., No. 61, 1908, p. 138; BAILEY, N. Amer. Fauna, No. 35, 1913, pp. 35, 45; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 102.

Thamnophis elegans ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, pp. 88, 120.

This snake is common in northern New Mexico, where it has been collected in San Juan (San Juan River), Rio Arriba (Abiquiu), Taos (Taos), McKinley (Zuñi River, Zuñi, Nutria, Fort Wingate), Santa Fe (San Ildefonso), San Miguel (Willis, Sapello Canyon at 10,000 feet), Bernalillo (Albuquerque), and Socorro (San Francisco Mountains) counties and at Chico Springs, Willow Spring, and Cantonment Burgwyn.

70. **Thamnophis marcianus** (Baird & Girard)
Marcy's Garter Snake

Eutaenia marciana COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 12.

Thamnophis marcianus RUTHVEN, Bull. U. S. Nat. Mus., No. 61, 1908, p. 58; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 20.

Cope recorded this snake from Socorro, Socorro County. The National Museum has specimens from Lincoln (ten miles north of Capitan Mountains) and Hidalgo (Animas Valley) counties.

71. **Thamnophis megalops** (Kennicott)
Mexican Garter Snake

Eutaenia megalops COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 1026; DITMARS, Reptile Book, 1907, p. 221.

Eutaenia megalops megalops BROWN, Proc. Acad. Nat. Sci. Phila., 1901, p. 21.

Thamnophis megalops RUTHVEN, Bull. U. S. Nat. Mus., No. 61, 1908, p. 44; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, pp. 86, 120; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 221; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 852; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 113.

Thamnophis macrostemma BAILEY, N. Amer. Fauna, No. 35, 1913, p. 35.

Cope and Ruthven record this species from Duck Creek, a tributary of the Gila River.

72. **Thamnophis radix** (Baird & Girard)
Racine Garter Snake

Thamnophis radix ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No.
Eutaenia radix COPE, Report U. S. Nat. Mus. for 1898, 1900, p. 1028.
2, 1913, p. 120.

Cope's record of a specimen from Fort Union, Mora County, seems to be the only one for the state.

73. **Thamnophis proximus** (Say)
Long's Garter Snake

Eutainia proxima BAIRD & GIRARD, Cat. N. Amer. Rept., Pt. I, Serpents, 1853, p. 25.

Thamnophis sauritus proxima ELLIS, Copeia, No. 43, 1917, p. 40.

Baird and Girard recorded this species as taken at Sabinal, Socorro County, and Medina, New Mexico. Ellis recently reported its capture at North Spring River, near Roswell, Chaves County.

74. **Thamnophis angustirostris** (Kennicott)
Brown-spotted Garter Snake

Atomarchus multimaculatus COPE, Amer. Naturalist, Vol. XVII, 1883, p. 1300 (type locality, **San Francisco River, New Mexico, near Arizona boundary**).

Tropidonotus multimaculatus GARMAN, Bull. Essex. Inst., Vol. XVI, 1884, p. 24.

Eutaenia multimaculata COPE, Proc. U. S. Nat. Mus., Vol. XIV, 1892, p. 665; BROWN, Proc. Acad. Nat. Sci. Phila., 1901, p. 31; DITMARS, Reptile Book, 1907, p. 239.

Thamnophis angustirostris RUTHVEN, Bull. U. S. Nat. Mus., No. 61, 1908, p. 120; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 100; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 855; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 112.

Cope's specimen from the San Francisco River, probably in Socorro County, remains the only record.

75. **Sonora semiannulata** Baird & Girard
Bicolor Ground Snake

Chionactis episcopus isozonus ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

A specimen in the National Museum, collected during the Mexican boundary survey, is doubtfully assigned to New Mexico in the museum records.

76. **Tantilla nigriceps** Kennicott
Sonoran Tantilla

Tantilla nigriceps Kennicott, Proc. Acad. Nat. Sci. Phila., 1860, p. 328 (type locality, Fort Bliss, New Mexico, and Indianola to Nueces, Texas). Cope, Bull. U. S. Nat. Mus., No. 1, 1875, p. 35; Coues, Surv. W. 100th Merid., Vol. V, 1875, p. 626; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 85; Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 31; Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 1114; Brown, Proc. Acad. Nat. Sci. Phila., 1901, p. 93; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 119.

Tantilla planiceps Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

This snake has been collected in Socorro (Socorro) and Dona Ana (Mesilla, Messilla Valley) counties, and on the Gila River.

77. **Micrurus euryxanthus** (Kennicott)
Sonoran Coral Snake

Micrurus euryxanthus Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 106; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 119.

Stejneger and Barbour give southern New Mexico as part of the range of this species.

78. **Sistrurus catenatus edwardsii** (Baird & Girard)
Edwards Massasauga

Caudisona miliaria Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 78.

Sistrurus edwardsii Cockerell, Amer. Naturalist, Vol. XXX, April, 1896, p. 326.

Sistrurus catenatus edwardsii Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 1146; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

The National Museum has this rattlesnake from Las Cruces, Dona Ana County, where it was found close to the college buildings, as reported by Cockerell. Yarrow's record of Sans-bois Creek, New Mexico, may relate to this snake.

79. **Crotalus molossus** Baird & Girard
Black-tailed Rattlesnake

Crotalus molossus Baird & Girard, Cat. N. Amer. Reptiles, Pt. I, Serpents, 1853, p. 10 (type locality, **Fort Webster, Santa Rita del Cobre, New Mexico**); Baird, U. S. Mex. Bound. Surv., Vol. II, 1859, p. 11, pl. XXV, figs. 1-8; Cope, Proc. Acad. Nat. Sci. Phila., 1866, p. 308; Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 12; Garman, Bull. Essex Inst., Vol. XVI, 1884, p. 34; Stejneger, Report U. S. Nat. Mus. for 1893, 1895, p. 424; Cope, Report U. S. Nat. Mus. for 1898, 1900, p. 1156; Brown, Proc. Acad. Nat. Sci. Phila., 1901, p. 101; Bailey, N. Amer. Fauna, No. 25, 1905, p. 50; Bailey, N. Amer. Fauna, No. 35, 1913, p. 35; Stejneger & Barbour, Check List N. Amer. Amph. Rept., 1917, p. 110; Stejneger & Barbour, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 125.

The Black-tailed Rattlesnake was first described from a specimen secured at Fort Webster, Santa Rita del Cobre, near the present Fort Bayard, Grant County. Cope collected it later at Lake Valley, Sierra County. In the National Museum are specimens from Grant (Fort Webster, Redrock, Gila National Forest), Hidalgo (Animas Peak), Luna (Florida Mountains), and Eddy (Guadalupe Mountains) counties.

80. **Crotalus atrox** Baird & Girard
Desert Diamond Rattlesnake

Crotalus adamanteus atrox Yarrow, Surv. W. 100th Merid., Vol. V, 1875, p. 529; Yarrow, Bull. U. S. Nat. Mus., No. 24, 1883, p. 75; Stone & Rehn, Proc. Acad. Nat. Sci. Phila., 1903, p. 33.

Crotalus scutulatus Cope, Proc. Acad. Nat. Sci. Phila., 1883, p. 11.

Crotalus atrox Stejneger, Report U.S. Nat. Mus. for 1893, 1895, p. 439; Bailey, N. Amer. Fauna, No. 25, 1905, p. 49; Ditmars, Reptile Book, 1907, p. 452; Ellis & Henderson, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; Bailey, N. Amer. Fauna, No. 35, 1913, p. 20.

Yarrow, Cope and Stone and Rehn have recorded this rattlesnake from Fort Wingate, McKinley County, Lake Valley, Sierra County, and Alamogordo, Otero County. The National Museum has it from Hidalgo (Livermore Spring and the Big Hatchet Mountains), and Guadalupe (Santa Rosa) counties.

81. **Crotalus confluentus** Say
Prairie Rattlesnake

Crotalus confluentus COPE, Proc. Acad. Nat. Sci. Phila., 1859 (1860), p. 337; YARROW, Surv. W. 100th Merid., Vol. V. 1875, p. 530; YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 77; COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 13; STEJNEGER, Report U. S. Nat. Mus. for 1893, 1895, p. 444; STONE & REHN, Proc. Acad. Nat. Sci. Phila., 1903, p. 33; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 35.

Crotalus confluentus pulverulentus COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 11 (type locality **Lake Valley, New Mexico**); COPE, Proc. U. S. Nat. Mus., Vol. XIV, 1892, p. 692.

Crotalus confluentus confluentus COPE, Report U. S. Nat. Mus. for 1898, 1900, pp. 1172, 1173.

The Prairie Rattlesnake has been taken in San Juan (Fruitland), McKinley (Fort Wingate), Mora (Fort Union), Quay (Tucumcari), Valencia (San Mateo, Acoma Pueblo), Socorro (Plains of San Augustin, and near the southern end of the Socorro Mountains five miles from Socorro), Sierra (Lake Valley), Grant (Gila, Hachita), Hidalgo (Animas Valley, Playas Valley), Otero (Alamogordo, and west of Guadalupe Mountains), and Eddy (Pecos River near 32°) counties.

82. **Crotalus lepidus** (Kennicott)
Green Rattlesnake

Crotalus lepidus COPE, Proc. Acad. Nat. Sci. Phila., 1883, p. 13; COPE, Proc. U. S. Nat. Mus., Vol. XIV, 1892, p. 692; STONE, Proc. Acad. Nat. Sci. Phila., 1911, p. 232; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 35; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 109; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 961; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 124.

Cope recorded this rattlesnake from the "summit of Magdalena Mountains, twenty miles northeast [?] of Socorro," Socorro County. Dr. Pilsbry secured the species in Sheridan Canyon, Big Hatchet Mountains, Hidalgo County, as recorded by Stone. The National Museum has specimens from Big Hatchet Mountains, Dog Spring and Animas Peak, Hidalgo County.

83. **Crotalus pricei** Van Denburgh
Price's Rattlesnake

The National Museum has received this rattlesnake from Steeple Rock, Grant County.

84. **Kinosternon sonoriense** Le Conte
Sonoran Mud Turtle

Kinosternon henrici LE CONTE, Proc. Acad. Nat. Sci. Phila., 1857, p. 4 (type locality, **New Mexico**).

Kinosternon sonoriense STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 112; VAN DENBURGH, Occas. Papers Cal. Acad. Sci., X, 1922, p. 967; STEJNEGER & BARBOUR, Check List N. Amer. Amph Rept., Ed. 2, 1923, p. 127.

This turtle was recorded from New Mexico by Le Conte in 1857. In the National Museum are specimens from the Mexican boundary and from Fort Union, Mora County.

85. **Kinosternon flavescens** (Agassiz)
Yellow-necked Mud Turtle

Cinosternum flavescens YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 31.

Kinosternon flavescens ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120.

Many more specimens are needed to show the relationship and distribution of the mud turtles of New Mexico.

86. **Pseudemys elegans** (Wied)
Cumberland Terrapin

Pseudemys elegans TRUE in YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 33.

Chrysemys elegans BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34.

In Yarrow's Catalogue this turtle is recorded by Dr. True as having been taken at Fort Union, Mora County. The specimen is still in the National Museum.

87. **Chrysemys marginata bellii** (Gray)
Western Painted Turtle

Chrysemys belli TRUE in YARROW, Bull. U. S. Nat. Mus., No. 24, 1883, p. 35; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; ELLIS, Copeia, No. 43, 1917, p. 40.

Chrysemys cinerea belli BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34.

Chrysemys marginata bellii STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 118; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 134.

True has recorded this turtle from the Rio Grande, New Mexico. The specimen still is in the National Museum. Ellis recently found this species in North Spring River, near Roswell, Chaves County.

88. **Terrapene ornata** (Agassiz)
Ornate Box Tortoise

Cistudo ornata COCKERELL, Amer. Naturalist, Vol. XXX, 1896, p. 326.

Terrapene ornata CRAGIN, Colorado College Studies, Vol. V, 1894, p. 37; RUTHVEN, Bull. Amer. Mus. Nat. Hist., Vol. XXIII, Art. XXIII, 1907, p. 595; ELLIS & HENDERSON, Univ. Colorado Studies, Vol. X, No. 2, 1913, p. 120; BAILEY, N. Amer. Fauna, No. 35, 1913, p. 34; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., 1917, p. 116; STEJNEGER & BARBOUR, Check List N. Amer. Amph. Rept., Ed. 2, 1923, p. 131.

Cockerell recorded this box turtle from Las Cruces, Dona Ana County. The National Museum has specimens from the Mexican boundary and from Las Cruces. Ruthven secured this species near Alamogordo, Otero County.

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

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XIII.

THE GENUS ERYTHRONEURA IN CALIFORNIA (HOMOPTERA)

BY

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The appearance of McAtee's revision of the genus Erythroneura has led me to go over the material in this genus accessible to me here at the Academy of Sciences, with the results noted below. I have never made any special attempt to collect the typhlocybids here in California and doubtless many more forms will be found when a careful search has been made for them. All specimens listed below were taken by me unless otherwise stated.

1. **Erythroneura obliqua dorsalis** Gillette

Alpine, San Diego County, July 4, 1913; Sisson July 26, 1918.

2. **Erythroneura obliqua nœvus** Gillette

Leona Heights, Alameda County, August (J. C. Bradley); Mill Creek Cañon, San Bernardino County, September 24, 1893.

3. **Erythroneura obliqua fumida** Gillette

San Diego, May 6, 10, 30, 1913; Cuaymaca Mountains, San Diego County, 5,000 feet, October 5, 1913.

4. **Erythroneura ternaria** Van Duzee, new species

Allied to *obliqua;* vertex strongly angled; dorsum with two sanguineous vittæ from middle of vertex to apex of elytra, connivent from middle of clavus. Length, 3.4 mm.

Vertex angled about as in *obliqua,* nearly twice longer at middle than at eye. Color pale yellow; vertex with a squarish red area either side next the eye; these areas are obliquely truncate before the front line of the eyes, leaving a parallel pale vitta between them nearly their own width, and are extended as broad vittæ across the pronotum and basal angles of scutellum to apex of elytra; on the elytra they are narrowed and follow the inner claval nervure to the middle of the claval commissure and on to the tip of the clavus where they join an elongated spot on the inner angle of the corium and are followed by a diffuse vitta on the inner apical areole; corium with indications of two longitudinal yellow vittæ. Last ventral segment of female strongly produced at the middle, which is minutely notched.

Described from two females taken at Mill Creek Cañon, San Bernardino Mountains, September 22, 1923. The red marks on the vertex divide its basal field into three subequal color areas; they do not approach anteriorly as in *obliqua* and the whole insect is proportionately stouter, the female segment is more produced and the vittæ are differently formed.

Type: Female, No. 1531, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, September 22, 1923, at **Mill Creek Cañon, San Bernardino County, California.**

5. **Erythroneura dentata** Gillette

Berkeley, September 1, 1914; Leona Heights, Alameda County, August (J. C. Bradley); Ocean Beach, San Diego County, May 13, 1913; San Diego, May 4, 6, 1913; Alpine, San Diego County, June 8, 1913; Sweetwater Valley, San

Diego County, June 18, 1913; Fosters, San Diego County, May 24, 1913.

6. **Erythroneura dentata bilocularis** Van Duzee, new subspecies

Form and markings nearly of *dentata* Gillette, to which species it runs in McAtee's tables of 1920. Length, 3 mm.

Head well produced, rounded at the somewhat swollen apex, broader and blunter than in *dentata*. Pronotum broader posteriorly with the sides more oblique than in *dentata*, about a third longer than the vertex. Elytra as in *dentata*, the inner apical areole feebly but distinctly angled at base. Last ventral segment of female abruptly produced on median third, its apex truncate or scarcely notched. Plates of male produced in a long, nearly parallel finger, upturned at tip, much as in *dentata*.

Color clear light yellow paling to whitish at apex and base of vertex, on apical median line and humeral angles of pronotum, inner areas of corium, legs and lower surface; disk of tergum, base of venter and oviduct black; disk of pronotum (notched before) and scutellum dusky red to fuscous, the basal angles of scutellum deeper fuscous. Sometimes the sides of the vertex and cheeks are infuscated. Elytra marked with red about as in *dentata*, the clavus red with a semi-circular spot at apex of scutellum and its apex yellow; corium with a broad semi-circular red vitta resting on the red of the clavus and attaining the base of the inner apical areole, exteriorly reaching to the first, or at least to the second, sector, these markings leaving two nearly circular pale spots when the elytra are closed, one resting on apex of scutellum, the other covering apical third of clavus; apical areoles faintly fuliginous, the veins yellow; stigma faintly whitish.

Described from two male and six female examples taken by me at San Diego May 20 and June 28, 1913, and near Alpine, San Diego County, June 18 and 21, 1913. Apparently this is but a strongly colored variety of *dentata*, as one individual shows traces of the yellow marks on the pronotum and has the red marks of the corium indicated only by a yellowish cloud.

Type: Male, No. 1532, and *allotype,* female, No. 1533, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 21, 1914, at **Torrey Pines, San Diego, California.** Paratypes in collection of the author.

7. **Erythroneura abolla varia** McAtee

Alpine, San Diego County, July 4, 1913.

8. **Erythroneura lusoria** Van Duzee, new species

Near *illinoiensis* and possibly but a subspecies. Length, 3 mm.

Head distinctly longer and more pointed than in *illinoiensis;* base of inner apical areole evenly curved as in the *obliqua* group. Color when fully pigmented, whitish, more or less tinged with yellow, especially beneath; head immaculate; pronotum with an orange discal spot near base; scutellum immaculate; elytra with six red spots and two black points; clavus with three red spots, a small one at base, another at tip and a larger angulate median one which quite crosses the disk and sometimes connects with the anterior one along the suture; radial area of corium with a square spot just behind the large one of the clavus and an elongated one near the apex; first transverse vein red; base of inner apical areole with a black spot and a smaller one is near the middle of the costa. Male valve short; plates broad, oblique at apex, but little surpassing the middle of the elongated pygofers.

Described from one male and eighteen female examples taken by Dr. J. C. Bradley at Leona Heights, Alameda County, in August. In immature examples the spots nearly or quite disappear.

Type: Male, No. 1534, and *allotype,* female, No. 1535, Mus. Calif. Acad. Sci., collected by J. C. Bradley at **Leona Heights, Alameda County, California.**

9. **Erythroneura coryli** Van Duzee, new species

Allied to *harti* but with the red elytral markings reaching to the transverse veins. Length, 3 mm.

Narrower than *harti* with a more pointed vertex; two spots on base of vertex, sometimes fused, one on anterior margin of pronotum, behind each eye and a larger one on posterior disk of pronotum, red or yellow, the latter mark obcuneiform and notched anteriorly; scutellum marked with red or yellow at either angle; elytra with a sanguineous vitta beginning near the sutural base of clavus, extended inward to cover the middle third of the claval commissure, then deflected to the stigma and back to the base of the fourth apical cell; sometimes this red invades the transverse and adjoining veins; a black dot on base of inner apical areole and usually another at apex of stigma; apical areoles slightly tinged with fulvous.

Described from four males taken by me on hazel bushes at Cazadero, April 13 and 14, 1918.

Type: Male, No. 1536, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, April 13, 1918, at **Cazadero, California.**

10. **Erythroneura comes ziczac** Walsh

Oakland Hills, Alameda County, April 16, 1916; Lakeport, Lake County, August 2, 1916; Leona Heights, Alameda County, August (J. C. Bradley).

11. **Erythroneura comes octonotata** Walsh

Laurel Dell, Lake County, August 3, 1916.

12. **Erythroneura comes coloradensis** Gillette

Lakeside, San Diego County, May 8, 1913; Alpine, San Diego County, October 4, 1913; Pine Hills, San Diego County, 4,200 feet, October 20, 1913.

13. **Erythroneura tergemina** Van Duzee, new species

Aspect of *lusoria* but pertaining to the *bipunctata* group in McAtee's paper and apparently related to *abolla* but with a more pointed vertex and marked by a black point at apex of head. Length, 3 mm.

Head about as in *tricincta* or a little more acute; base of inner apical areole obviously but not distinctly angled. Last ventral segment of female produced in an acute point. Color whitish, a little tinged with yellow on the head and abdomen, the tergum marked with fuscous or black near base; vertex with a large orange or red basal spot either side of the median line, usually with a fuscous point at its inner apical angle, these forming a triangle with the black point on the tip of the head; pronotum with two large discal spots which may be extended into an irregular transverse band; basal angles of scutellum red, its apex yellow with the extreme tip minutely black; elytra with about six orange or red spots, two on clavus, one basal and one medial, one adjoining the latter on radial area of corium and one at its apex, an indication on middle of costa and another at apex of stigma; apical areoles slightly enfumed but without black points.

Type: Female, No. 1537, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, October 4, 1913, at **Alpine, San Diego County, California.** One paratype, same data, in collection of author.

PROCEEDINGS

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XIV

A NEW SPECIES OF WHALE FROM THE TYPE LOCALITY OF THE MONTEREY GROUP

BY

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AND

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In November, 1923, during the excavation for the foundation of a plant for the manufacture of insulation from diatomaceous earth near Monterey, California, Mr. C. A. Ryan, President of the Monterey Products Company, noticed that the workmen were encountering the bones of a whale. Although some damage had then been done, greater care exercised thereafter enabled him to extract the skull in fairly complete condition. It is through his interest in science that the specimen was donated to the California Academy of Sciences.

The location of the plant, and, therefore, the type locality of the whale, is just to the south of the road from Salinas to Monterey, and about five miles east of the latter town. The property forms a part of the old Saucito Rancho.

This is the region of the type locality of the Monterey Group of the Miocene, and, for this reason, the whale is of particular importance. Unfortunately, the skull only was unearthed, but Mr. Ryan was of the opinion that the remainder of the skeleton was in place.

June 14, 1924

The strata of the exposure dip to the westward at an angle of about 45°, and the strike is northeast. The buildings are erected at the base of a steep incline on the west side of a creek, the slope being composed of diatomaceous earth. The top stratum is loose and scarcely consolidated, characters which accompany the upper part of the Monterey shale member wherever definitely exposed. At this point it is approximately 50 feet thick. Below this loose, purer grade of material, there is exposed about 75 feet of thinly bedded, more consolidated earth with occasionally some "opalized" or "flinty" shale.

The skull was embedded in soft material and was, therefore, easy to prepare. It had been slightly crushed in the palatine region and on the dorsal side, but so little was this that the pieces readily came together again in their natural position. In the deeper recesses and cavities of the skull, the siliceous material had become cherty and was difficult to remove. This effectually prevented the removal of the periotic bones.

Balænoptera ryani Hanna & McLellan, new species

(Plates 5 to 9)

Type: No. 1733, Mus. Calif. Acad. Sci. (Dept. Paleo. Type Coll.), collected by C. A. Ryan, **five miles east of Monterey, California,** November, 1923.

Horizon: Type locality of Monterey Group, Miocene.

Description: Occipitals fused, their limits indeterminate posteriorly. Foramen magnum nearly circular, plane of its orbit decidedly dorsal. Condyles broad (horizontal diameter about three-fourths vertical diameter), pitted, strongly convex dorso-ventrally, depressed transversely, only slightly elevated above surrounding areas laterally, and defined by a clearly characterized ridge; lateral margins strongly convex, mesal margins nearly straight; separated dorsally by nearly the diameter of foramen magnum and ventrally by a deep, narrow channel. Supraoccipital forming dorsal shield and extending far forward; roughly triangular in outline, broad basally, apically constricted, width at apex approximately one-sixth length, median width nearly four-fifths length; deeply concave anteriorly; longitudinal ridge obsolete caudally, becoming more evident towards rostrum. Squamosals greatly thickened antero-posteriorly; squamous portion apparently not entering into dorsal surface, meeting supraoccipital at superior margins of temporal fossæ; anterior margins crescentic in outline, antero-external divisions of falcate processes limited by lateral walls of the pterygoids, and extended mesally to form part of outer walls of pterygoid fossæ; well defined groove extending upward and outward from region of sphenoidal fissures. Parietals forming nearly entire walls of temporal fossæ, deeply concave mesally, superior margins extended laterally to join inferior edges of supraoccipital; apparently overlying frontals to slight extent on vertex; broadly rounded posteriorly, contiguous with articular processes of squamosals. Alisphenoids apparently small, interposed between parietals and pterygoids. Orbital processes of frontals horizontal, and at a level much lower than vertex. Vomer projecting between, below, and posterior to, palatines; ventral margin swollen and keeled; thin vertical plate thickening rostrally; horizontal plates extending laterally from superior margin to meet ascending wings of palatines and internal walls of pterygoids, and caudally to overlie basisphenoid. Palatines broad, diagonal ridges irregularly separating horizontal and vertical surfaces; posterior margins (considered together) obomegoid in outline. Pterygoids well developed, externally interposed between squamosals and palatines, and extending upward to sphenoidal fissures; inclosing deep pterygoid (scaphoid)[1] fossæ, opening in the direction of, and ventral to, tympanic cavity; roofs of fossæ sloping strongly upward; hamular processes large, rounded at proximal extremities, slightly convergent and somewhat inclined dorsally. Basioccipital rather broad, concave; swollen portions of lateral margins uniting with inner walls of pterygoids to form internal walls of tympanic cavities. Tympanic cavities bounded externally and posteriorly by squamosals and exoccipitals. Tympanic bullæ rounded posteriorly, keeled, and truncated at apex; inner surface flattened, free margin very straight, longitudinal groove extending in proximity to keel; lips thickened, slightly sinuous, striated with vertical grooves, and with well marked Eustachian notches; external surfaces (damaged) showing little trace of deep transverse grooves. Periotics abutting on external walls of tympanic cavities, irregular in form; ventral apices directed forward and downward towards pterygoid fossæ.

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[1] Ridewood, Phil. Trans. Roy. Soc. London, ser. B, vol. 211, pp. 263 *et seq.*

TABLE OF MEASUREMENTS

	Mm.
Length of supraoccipital from anterior margin of foramen magnum to apex	300.
Breadth of supraoccipital at apex (est.)	50.
Median breadth of supraoccipital (est.)	220.
Depth of concavity of supraoccipital	14.4
Width of foramen magnum	53.
Horizontal diameter of condyle	75.
Vertical diameter of condyle	101.
Length of left tympanic bulla (est.)	94.
Width of left tympanic bulla (est.)	52.
Width of basioccipital between tympano-periotic recesses	150.
Width of basioccipital at bases of descending processes	65.
Distance between extremities of hamular processes	96.
Depth of pterygoid fossa (to apex of hamular process)	108.
Antero-posterior length of combined pterygoid and tympano-periotic recesses	147.5
Greatest dorso-ventral depth of skull	268.
Dorso-ventral depth of skull from vertex to vomer (est.)	155.
Breadth of palatines at base of proximal margin of orbital process of frontal	185.

While bearing a superficial resemblance to many of the Balænopteridæ, *Balænoptera ryani* most closely approaches *B. acuto-rostrata* Lacépède and the doubtfully distinct *B. davidsoni* Scammon. Apparently, however, the new species is differentiated from its congeners, recent and fossil, by the marked lateral constriction in the region of the vertex, the short dorso-ventral depth of skull from vertex to vomer, the relative breadth of palatine region, the dorsal aspect of foramen magnum, and the distinctive form of the tympanic bullæ.

EXPLANATION OF PLATES

PLATE 5

Type skull of *Balænoptera ryani*, new species. About one-third natural size. Dorsal view. [In the process of engraving, part of the figure, showing the fragment of the right squamosal, was deleted from the plate. The actual extent of this portion of the skull may be seen in Plate VI.]

PLATE 6

Type skull of *Balænoptera ryani*, new species. About one-third natural size. Ventral view.

PLATE 7

Fig. 1. Right tympanic bulla of type skull of *Balænoptera ryani*, new species. About natural size. Superior view.

Fig. 2. Right tympanic bulla of type skull of *Balænoptera ryani*, new species. About natural size. Free border.

Fig. 3. Type skull of *Balænoptera ryani*, new species. About one-third natural size. Lateral view.

PLATE 8

Fig. 1. Left tympanic bulla of type skull of *Balænoptera ryani*, new species. About natural size. Superior view.

Fig. 2. Right tympanic bulla of type skull of *Balænoptera ryani*, new species. About natural size. Free border.

Fig. 3. Right tympano-periotic bones of type skull of *Balænoptera ryani*, new species, in situ. About two-thirds natural size.

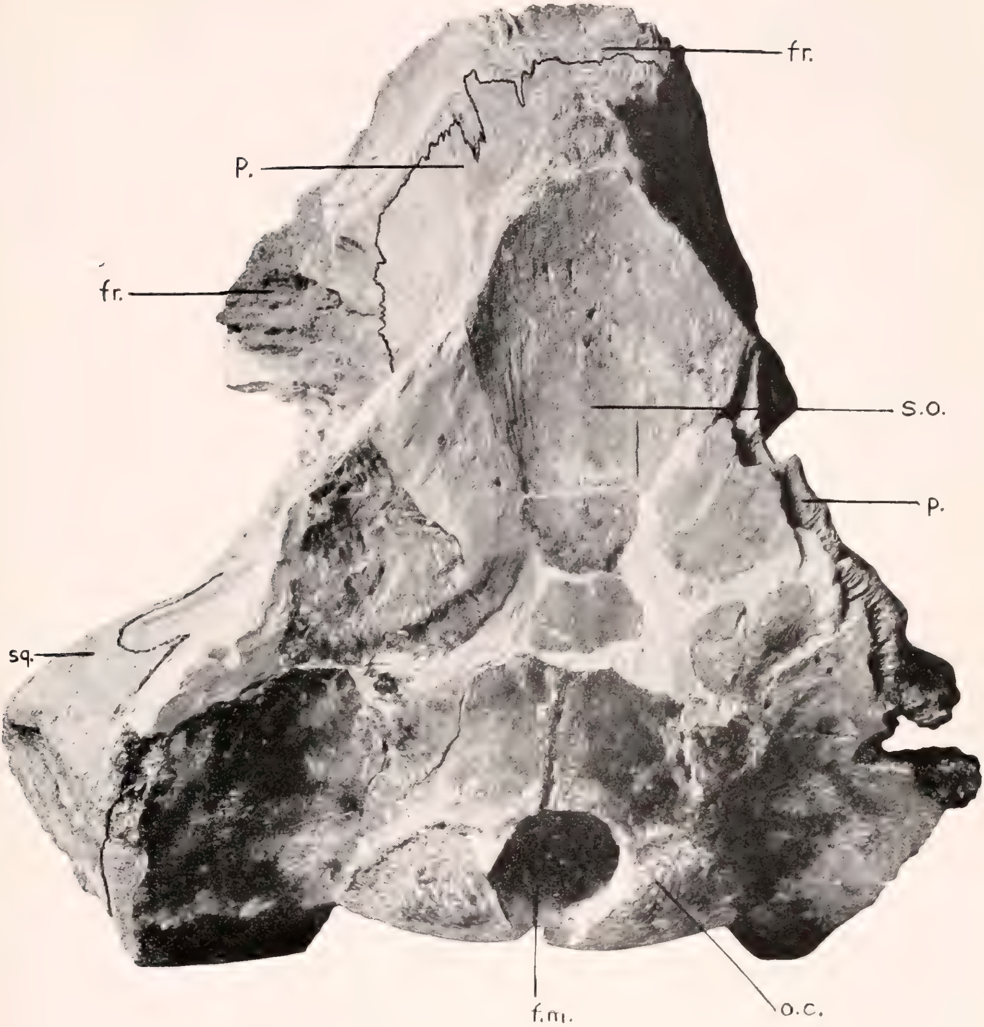
PLATE 9

Fig. 1. Left tympanic bulla of type skull of *Balænoptera ryani*, new species. About natural size. Free border.

Fig. 2. Left tympanic bulla of type skull of *Balænoptera ryani*, new species. About natural size. Anterior view.

Fig. 3. Left tympano-periotic bones of type skull of *Balænoptera ryani*, new species, in situ. About nine-tenths natural size.

The same abbreviations are used on Plates 5 to 9 for the following parts: s.o., supraoccipital; b.o., basioccipital; e.o., exoccipital; o.c., occipital condyle; fr., frontal; p., parietal; pa., palatine; pt., pterygoid; pe., periotic; pt.f., pterygoid fossa; t.b., tympanic bulla; ha., hamular process; sq., squamosal; sq.g., squamosal groove; al., alisphenoid; vo., vomer; f.m., foramen magnum.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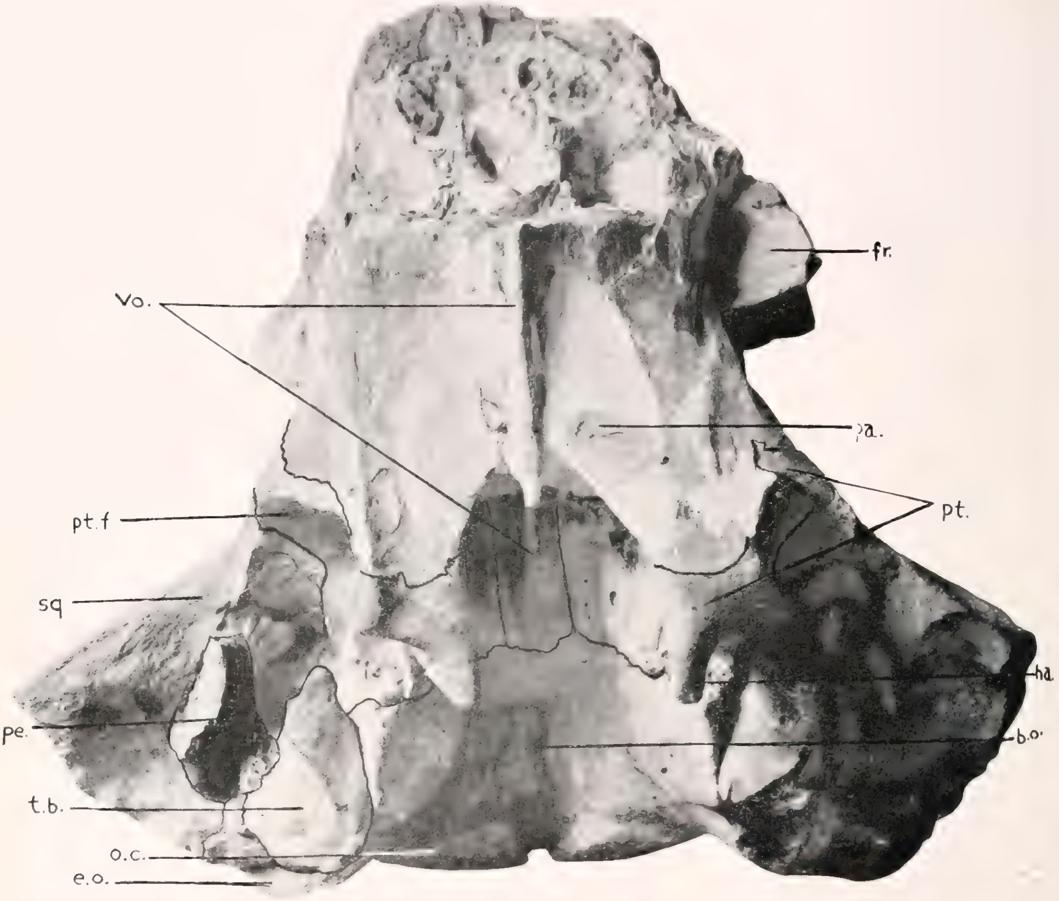
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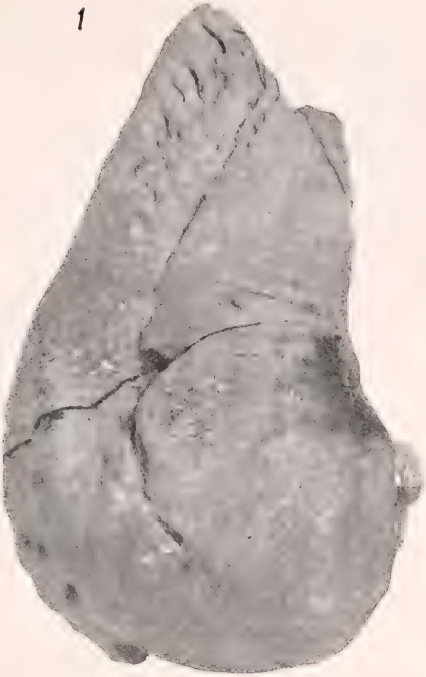

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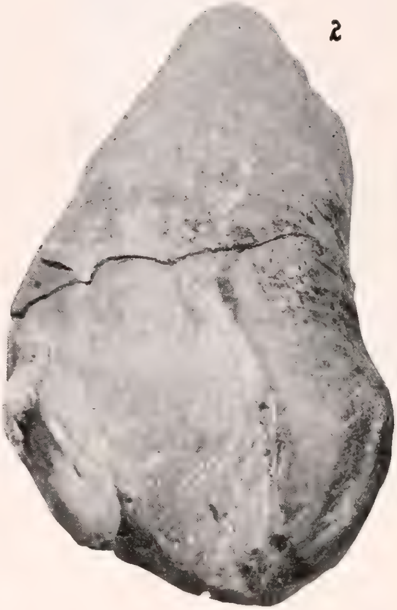

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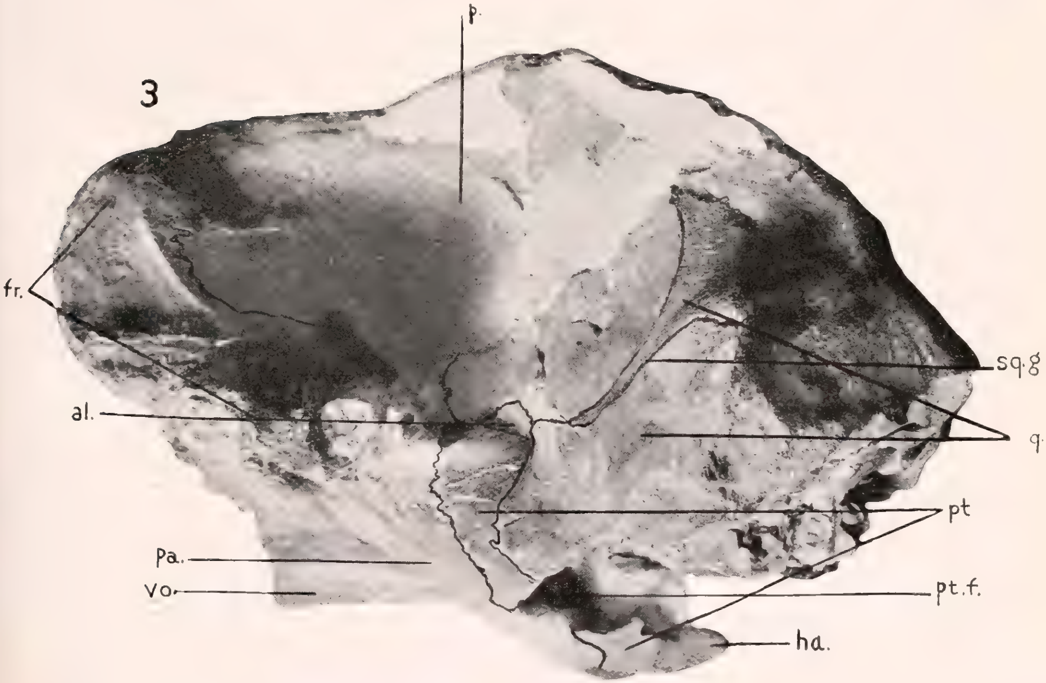

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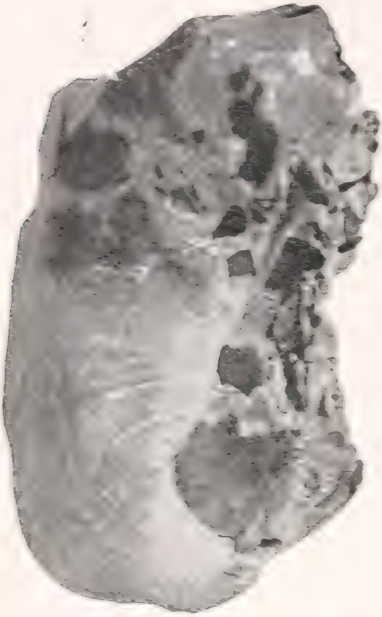

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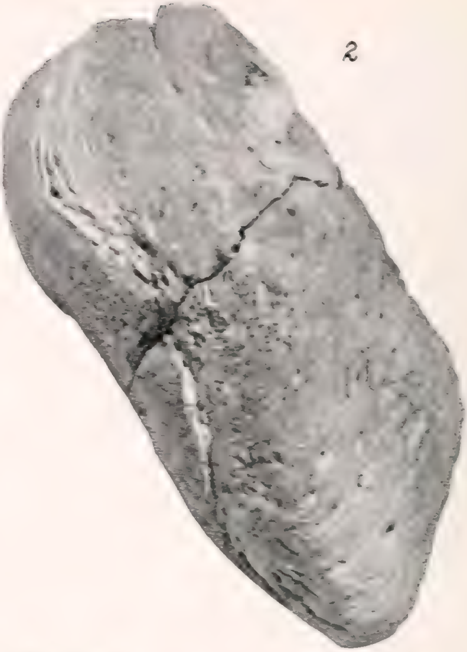

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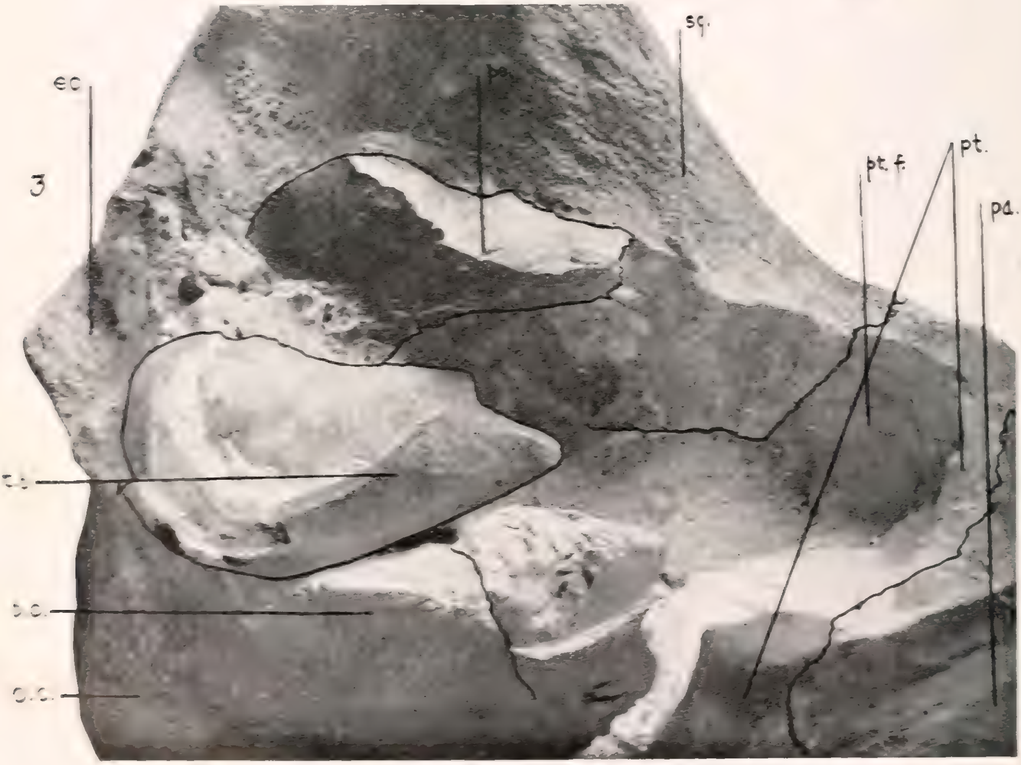

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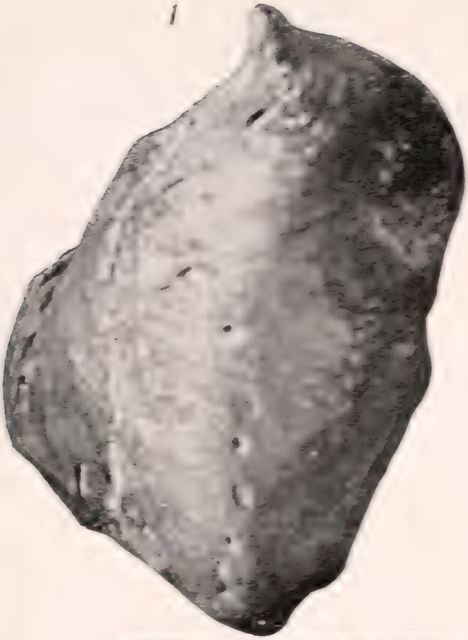

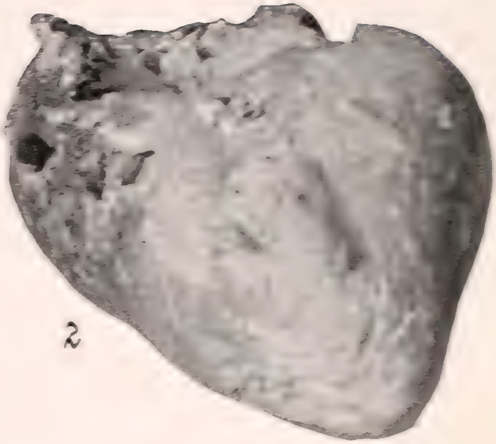

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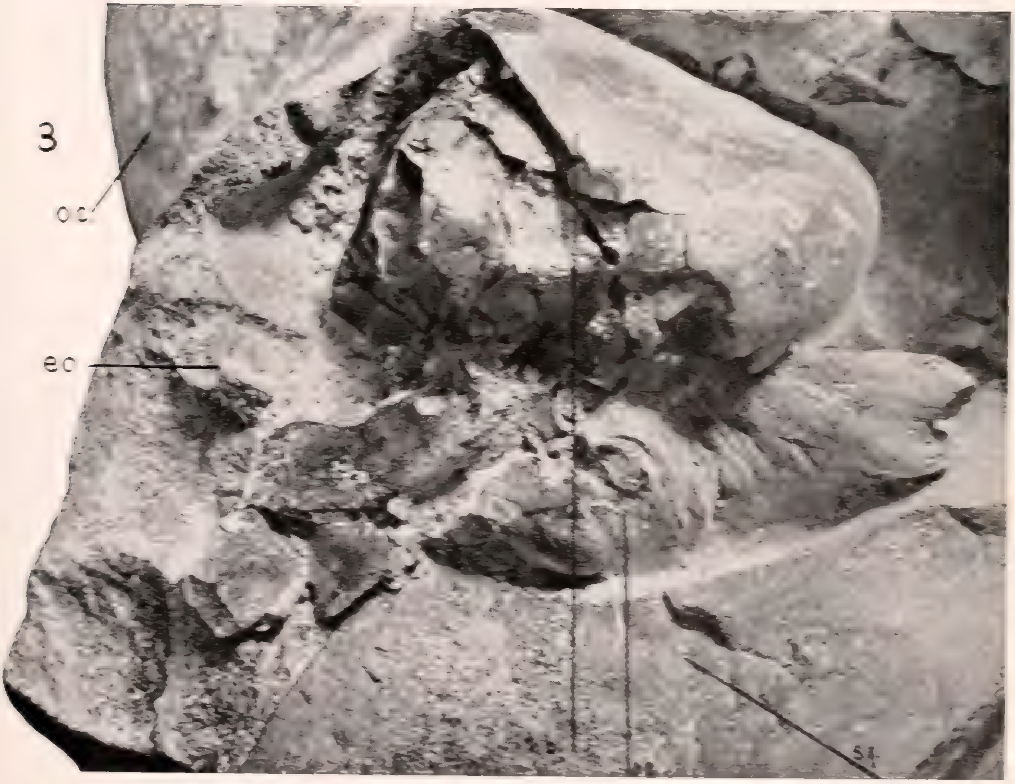

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XV

CONTRIBUTIONS TO ORIENTAL HERPETOLOGY

I. SAKHALIN

BY
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The known herpetological fauna of Sakhalin Island seems to include but five or six species. These are one salamander, one toad, one or two frogs, one lizard, and one snake.

1. **Hynobius cristatus** (Anderson)

This salamander is not represented in our collections. It was described from a single specimen from Sakaehama, on the east coast of Sakhalin. Dunn refers to this species also a specimen from this island recorded by Nikolski as *Salamandrella keyserlingii.*

2. **Bufo bufo sachalinensis** (Nikolski)

The toad Sakhalin seems to be most closely related to the form which Stejneger describes under the name *Bufo bufo asiaticus,* which he says is found in Mongolia, Manchuria, Amurland, Korea, and northeastern China. The apparent differences between the two are so slight, and variation in all the oriental forms of *Bufo bufo* is so great, that, in spite of its insular habitat, it seems best to follow Nikolski in regarding the Sakhalin toad as a subspecies rather than as a species.

November 6, 1924

Aside from its smaller size at maturity, the only differences I have found are that the internal metatarsal tubercle is larger and more elongate than in Chinese specimens of the same size, the web in one specimen is somewhat larger, and in some specimens the tympanum is larger just as it is in some Japanese toads. With the exception of the large metatarsal and the small size of the toad at maturity, these differences are covered by individual variation. It is possible that the smaller size at maturity may be due to slower growth resulting from less favorable environmental conditions, and the greater age of specimens of the same size may account for the relatively larger metatarsal tubercles. The coloration is as in Chinese toads.

From the toad of Japan, *B. b. sachalinensis* differs in coloration, as does the Chinese subspecies, in the usual absence of the dark line on the lower jaw and the reduction of dark pigmentation on the sides of the body and on the belly. The metatarsal tubercle is relatively larger than in toads of the same size from Japan.

Larger series from Sakhalin may show that the toad of this island does not really differ from that of the Asiatic mainland.

There are in our collection fifteen toads collected at Toyohara, Sakhalin, in August, 1910. Unfortunately, only four of these are adult. The others (Nos. 26087, 26089, 26091, 26092, and 26094 to 26100) are too small to show distinctive characters. Conclusions as to the distinctness of this subspecies, therefore, must be based upon the four adult toads (Nos. 26088, 26090, 26093 and 26750).

No. 26088 has a small tympanum; first and second fingers equal, without pads; web as extensive as in Chinese or any of the Japanese toads. The inner metatarsal tubercle is larger and longer than in Chinese toads of the same size. There is no dark line along the lower jaw. The parotoid is edged with black but there is almost no dark pigmentation of the side of the body. There is a trace of a dorsal line. The belly shows few small dark spots. There is no tarsal fold or ridge of tubercles. The subarticular tubercles are paired.

No. 26090 has a large tympanum. The second finger is a little longer than the first. There are no breeding-pads. The web is as extensive as in No. 26088. The metatarsal tubercle is large and long. There is no dark jaw-line. The parotoid is dark-edged and there is a little dark pigment on the sides of the body. Some traces of a dorsal line are present. The belly has a few small dark spots. There is no tarsal fold or ridge of tubercles. The subarticular tubercles are paired. The heel reaches the shoulder. This specimen measures 70 mm. from snout to vent. It is a female and contains many well-developed eggs.

No. 26093 has a small tympanum; first and second fingers equal, without pads; web as extensive as in Nos. 26088 and 26090; large, long metatarsal tubercle; no dark line on jaw; parotoid dark-edged; a little dark on sides of body; trace of a dorsal line; a few small spots on belly; no tarsal fold or ridge of tubercles; subarticular tubercles paired.

No. 26750 has a moderately large tympanum. The first and second fingers are about equal and bear well-developed pads. The web is more extensive than in any of the other specimens. The metatarsal tubercle is large and long. There is no line on the jaw. The parotoid is dark-edged. There is some dark pigmentation on the sides of the body. A trace of a dorsal line is present. The belly shows a few small spots. In the position of a tarsal fold is a ridge of small tubercles along the tarsus, as in some Korean specimens. The subarticular tubercles are paired. The heel reaches the tympanum. The length from snout to vent is 68 mm.

3. **Rana temporaria** Linnæus

There are at hand twelve specimens collected at Toyohara in August, 1910. All of these have short snouts, the distance from the orbit to the tip of the snout being not greater than the width between the dark stripes at the anterior borders of the orbits. The webs are larger than in most specimens of *Rana japonica*. The inner metatarsal tubercles are large. The outer metatarsal tubercle is absent in 25751, 25752, 25754, 25756, and 25757; present on one foot in 25750; and present on both sides in 25753, 25755, 25758, 25759, 25760, and 25761. The vomerine patches of teeth are almost entirely between the choanae in Nos. 25751, 25752, 25753, 25754, 25756, 25758, and 25760; between and behind in 25755; and chiefly behind in 25750, 25757, 25759, and 25761. Aside from this variation in the position of the teeth, and the usual variations in color, this series offers little worthy of note.

In addition to the series recorded above (Nos. 25750 to 25761), we have twenty-one younger specimens (Nos. 25770 to 25790). These also were taken at Toyohara in 1910. They all have short snouts and rather large webs.

The dorsolateral glandular ridge flares out toward the tympanum anteriorly in all of these thirty-three frogs. No. 25754 has dark spots on the throat and many of the other specimens have this region more or less pigmented.

4. **Lacerta vivipara** Jacquin

Nineteen specimens (Nos. 26068 to 26086) were collected by Victor Kühne at Toyohara, Sakhalin Island, August 28, 1910. I have been unable to detect any difference between these specimens and others from England and Ireland. Five of the specimens are very young. Femoral pores in the other fourteen lizards range from six to 13, being six four times, seven four times, eight six times, nine four times, ten six times, eleven three times, and thirteen once. The average for the twenty-eight thighs is 8.64.

5. **Vipera berus** (Linnæus)

There are two specimens of this snake.

No. 14579, a male, collected at the "South end of Sakhalin Island", has scales in 21 rows, gastrosteges 147, urosteges 40, supralabials 10-10, infralabials 11-11.

No. 26101, a male, collected at Toyohara, Sakhalin, by Victor Kühne, in 1910, has scales in 21 rows, gastrosteges 145, urosteges 38, anal single, supralabials 9-9, infralabials 10-10.

PROCEEDINGS

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XVI

ON LATICAUDA SCHISTORHYNCHUS AND LATICAUDA SEMIFASCIATA

BY

JOHN VAN DENBURGH

Curator, Department of Herpetology

Through the kindness of Dr. Stanley C. Ball, Curator of Collections, of the Bernice P. Bishop Museum of Honolulu, I recently have had an opportunity to examine four very interesting sea-snakes collected by Mr. C. F. Maxwell at Niue or Savage Island. These are numbers 291, 292, 293 and 294 of the Bishop Museum collection.* The island where these snakes were secured is the type locality of *Laticauda schistorhynchus* (Günther), and this little series of four specimens is of interest because it shows that this species is distinct from *Laticauda semifasciata* (Reinwardt) of the East Indies and Loo Choo Islands.

I have before me twelve specimens of the latter species, from Okinawa (No. 22093), Miyako (14997, 22094, 22095) and Ishigaki Shima (22096, 22101, 22103, 22104). In these the gastrosteges vary from 200 to 206 and the cross-bands from 30 to 39 on the body and five to seven on the tail. The black rings involve from two to three gastrosteges and three to five mid-dorsal scales.

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*One of these has very kindly been presented to the California Academy of Sciences by the authorities of the Bishop Museum.

November 6, 1924

The Niue Island specimens of *L. schistorhynchus* have scale rows 21, 23, 21, 23; gastrosteges 193, 192, 190, 194; urosteges 38, 35, 41, 40; supralabials 7-7, 7-8, 7-7, 7-7; temporals 2+3 in all; rostral touching 5, 4, 5, 5 shields, and divided in the first and last specimens; light rings on body 23, 24, 25, 23, on tail, 3, 4, 5, 4; black rings involving from three to six gastrosteges and six or seven mid-dorsal scales.

If we include the counts given by Boulenger and Stejneger, we find that the average number of gastrosteges in nine specimens of *L. schistorhynchus* is 188, while in twenty-one *L. semifasciata* it is 203. The difference in color seems to be quite constant.

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Head slightly transverse, eyes large and rather prominent, muzzle rather short and broad; front scarcely convex, feebly and longitudinally biimpressed from the epistomal base; very sparsely punctate, punctures coarse, those toward vertex rather deeply impressed; surface smooth and shining. Antennæ long, extending to beyond base of pronotum, rather stout, scarcely incrassate, bristling with pale setæ; joints five to 10 inclusive subserrate and subtriangular in form; third and fourth about as long as wide and somewhat swollen anteriorly, second subglobular.

Pronotum slightly to a third wider than long; apex narrower than base, widest behind the middle, subtruncate in moderate circular arc; sides moderately strongly arcuate posteriorly, becoming straighter and noticeably convergent anteriorly to the apical angles which are rounded; disk rather strongly convex and declivous antero-laterally, very sparsely and coarsely punctate; punctures separated by a distance equal to three to five times their diameter, surface smooth throughout, punctures smaller laterally; sides, when viewed obliquely, appearing very strongly and continuously arcuate with the apex and base.

Elytra usually less than twice as long as wide; sides parallel to divergent posteriorly according to sex, either straight or feebly and broadly arcuate; apex broadly rounded; side margins distinctly but not broadly explanate and moderately reflexed; apical margin serrulate; humeri rather large, somewhat tumid and moderately broadly rounded; base transverse, scutellum more or less transverse; disk rather coarsely but not sharply punctate, surface rather rugosely irregular.

Abdomen very finely and sparsely punctate. Legs moderate in size and stoutness; tarsi moderately stout.

Male usually smaller and rather parallel; fifth ventral segment arcuato-truncate at apex. Female larger; distinctly broader posteriorly, slightly depressed; fifth ventral segment rather strongly arcuate at apex.

Measurements: Length (types) 2.7-3.5 mm.; width 1-1.6 mm.

Type: Male, No. 1566, and *allotype,* female, No. 1567, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, April 7, 1923, at **Potholes, California.** *Paratypes* same data, in the collection of the Academy of Sciences and in that of author.

From cactus blossoms; a series of 29 specimens studied. *A. puncticeps* is a very pretty and distinct species; in facies, suggestive of a small *Tanaops. A. explanatus* Casey is before me and differs from the above species in its dual pubescence. *A. puncticeps* is to be distinguished from *rufiventris* by its sparsely and coarsely punctate head, subserrate antennæ; and marginal cilia not fimbriform.

2. **Trichochrous hesperius** Blaisdell, new species

Form elongate oblong-oval, three times as long as wide, rather parallel, moderately strongly convex. Color black, shining; antennæ and legs piceous, femora darker; mouth-parts more or less pale. Pubescence uneven in distribution, short and sparse, recumbent and without longer erect hairs, grayish in color, except where it becomes brownish on the central (and greater) part of each elytron, and middle of the pronotum; pale hairs most conspicuous along the suture, at base, on the deflexed sides and over the apex of the elytra; pronotal and elytral fimbriæ pale in color, rather short and well developed.

Head relatively somewhat small, about as long as wide, rounded in outline not including the muzzle, the latter rather short and parabolic; epistoma testaceous; front almost plane, with a small glabrous area opposite base of the epistoma; central area densely punctato-reticulate, less so toward the vertex; eyes rather large and convex. Antennæ rather slender, moderately short, attaining about the middle of the pronotal disk; distinctly but not strongly incrassate in distal half, not serrate; joints seven to 10, slightly asymmetric and very feebly transverse, fifth slightly larger than fourth or sixth, the latter as long as wide; eleventh short, obovate and pointed at apex.

Pronotum transverse, at least a half wider than long, moderately and evenly convex; apex slightly arcuate in feeble circular arc; sides broadly and rather feebly arcuate in middle two-fourths, a little convergent anteriorly, becoming more strongly arcuate both anteriorly and posteriorly, continuously so with the broadly rounded angles; base moderately but broadly arcuate, feebly sinuate just within the site of the angles; disk sparsely and not very finely punctate, punctures well defined, rounded and very slightly subasperate in the central area where they are separated by a distance equal to two to four times their diameter; here the intervening surface is smooth, gradually becoming recticulate towards the sides where the sculpturing is rather loosely reticulato-punctate.

Elytra oblong, about twice as long as wide, slightly flattened on the dorsum; sides parallel and at posterior third becoming arcuate, continuously so with the broadly and rather conjointly rounded apices; punctures of the disk not sharply defined, fine and somewhat impressed in the transverse and feeble depressions, moderately closely arranged; humeri scarcely tumid and rather narrowly rounded.

Abdomen and metasterna finely punctate; prosternum glabrous. Legs rather slender and moderate in length; tibiæ noticeably slender in basal half; metafemora subfusiform.

Measurements: Length (type) 3 mm.; width 1 mm.

Holotype: A unique female, in the author's collection, from Pasadena, California.

Described from a single female, in which the fifth ventral abdominal segment is arcuately rounded at apex. According to Casey's table of species it must be placed near *inæqualis* Casey, from which it differs radically in the densely punctato-reticulate head and pronotal disk laterally, and the broadly rounded pronotal angles. In appearance it resembles *benedicti* described below, but in that species the basal pronotal angles are subobtuse, the base is not broadly sinuate within the site of the angles, the epistoma is black and the tibiæ stouter. In both species the pubescence is quite similar. *T. benedicti* is rather more robust and the fimbriæ blackish, not pale as in *hesperius;* in the latter the epistoma is testaceous.

3. **Trichochrous benedicti** Blaisdell, new species

Form oblong-oval, about 2½ times as long as wide and moderately convex. Color deep black; tibiæ and tarsi more or less rufo-piceous; antennæ piceous, slightly paler toward base. Pubescence subdecumbent, without trace of erect hairs; moderately sparse and brownish black in color, becoming paler along the suture, on the deflexed sides of the elytra, somewhat diffusely so on the apices and sides of the pronotal disk. Marginal cilia of the pronotum moderate in length, closely placed and curved backward; those of the elytra of moderate and quite uniform length.

Head about as long as wide, eyes large, muzzle short; front scarcely impressed, rather coarsely and more or less densely reticulato-punctate, less so on vertex and behind the epistoma. Antennæ not stout or serrate; relative size and proportions of the joints nearly as in Listrus.

Pronotum moderately transverse, about a third wider than long; apex arcuato-truncate; sides rather strongly arcuate posteriorly, less so and slightly convergent anteriorly; widest behind the middle; angles broadly rounded, the apical rather less so; base moderately and broadly arcuate, continuously so with the sides; disk moderately and rather evenly convex from side to side, reticulato-punctate in about lateral fourth, central area very sparsely punctate, punctures round and rather sharply defined, separated by a distance equal to three or four times their diameter.

Elytra oblong-oval, sides more or less parallel, rather broadly and evenly rounded at apex; disk moderately convex, not closely punctate; punctures not sharply defined and separated by a distance equal to about three times their diameter; surface slightly transversely rugose.

Abdomen finely and not densely punctate. Legs moderately slender.

Male more parallel; fifth ventral abdominal segment rather more densely punctate and sinuato-truncate at apex, subequal in length to the fourth. Female rather less parallel, sides of the elytra noticeably more arcuate; fifth ventral almost twice as long as the fourth, rather subasperately punctate and broadly rounded at apex.

Measurements: Length (types) 2.5-3 mm.; width .9-1.1 mm.

Holotype, male, and *allotype,* female and one *paratype,* in author's collection.

Type locality: Los Angeles County, California; collected on April 4, 1923, by Mr. Warwick Benedict, after whom I have named the species. One male and two females have been studied.

This appears to be a very distinct species which, according to Casey's table, falls near *inæqualis* Casey, from which it differs in having the sides of the pronotal disk reticulato-punctate, legs and antennæ darker, the fifth ventral abdominal segment rather less modified, and the surface polished and shining.

4. **Trichochrous imperialensis** Blaisdell, new species

Form oblong-subovate, feebly narrowed anteriorly, moderately convex, a little more than twice as long as wide. Color black; tibiæ and tarsi somewhat piceous. Pronotal disk more or less shining. Pubescence flavo-plumbeous in color, dense, hiding the surface on the elytra; blackish on the central area of the pronotum and front of head; decumbent and moderately short; sparsely intermixed with rather long erect hairs which are pale in color and subserial on the elytra and black on the pronotum and head; hairs pale on the epistoma. Pronotal fimbriæ pale, rather long, not very closely spaced and not mutually backwardly curved; elytral fimbriæ longer, rather more widely spaced and bristling.

Head somewhat transverse, eyes moderately large not very prominent, sharply facetted; muzzle prominent and quadrate; front nearly plane, sparsely punctate, punctures moderately small; epistoma glabrous, surface rather irregular. Antennæ of moderate length and stoutness, joints 5 - 10, moderately serrate and asymmetric, fourth subtriangular.

Pronotum about a fourth wider than long, moderately strongly convex; apex broadly arcuate; sides broadly rounded, very feebly and quite broadly sinuate posteriorly, rounding into the apex anteriorly; base broadly arcuate; basal angles obtusely rounded; disk finely punctate, punctures rounded and well defined, separated by a distance equal to three or four times their diameter, surface smooth throughout.

Elytra oblong-oval, a little wider than the prothorax, sides parallel in basal half, thence broadly arcuate into the broadly rounded apex; disk feebly convex on the dorsum, rather strongly and arcuately declivous laterally; finely punctate, surface obsoletely and finely irregular; humeri rather tumid and subevenly rounded, bearing a few black hairs. Scutellum slightly wider than long and evenly rounded apically.

Abdomen finely punctate, third and fourth segments equal in length, fifth apparently rather broadly arcuate at apex, surface slightly asperate along the apical margin centrally. Legs moderate in length and stoutness.

Measurements: Length 3 mm.; width 1.4 mm.

Type: Apparently a female, No. 1568, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, April 9, 1923, at **Potholes, Imperial Co., California.**

A single specimen, presenting distinctive characters. *T. imperialensis* has the bristling hairs of the pronotum and head black in color, with the decumbent hairs of the central area of the former also black; pronotal fringe pale and well developed; apical pronotal angles rounded, the basal obtusely rounded, and the abdomen clothed with soft grayish moderately long hairs. This species should follow *pruinosus* Casey in the cabinet arrangement. In *pruinosus* the pronotal fimbriæ are black, long, stiff and sparse; apical angles slightly obtuse and narrowly rounded, the basal obtuse and not rounded. In both species the sides of the pronotal disk are smooth.

5. **Trichochrous gradatus** Blaisdell, new species

Form elongate, oblong-oval, quite parallel, moderately convex and about 2½ times as long as wide. Color black to slightly piceous; legs, antennæ and mouth parts, more or less piceous. Surface more or less shining. Pubescence pale luteo-cinereous throughout, not dense, recumbent hairs moderate in length, intermixed on the elytra with longer semi-erect, coarser hairs which are feebly subserial in arrangement; head and pronotum without erect hairs. Pronotal fimbriæ moderately short, apical fringe shorter and more crowded; elytral fimbriæ longer and more widely spaced. Hairs of the abdomen finer.

Head about as long as wide, eyes large and only moderately convex; muzzle about as long as wide; front plane, not impressed, distinctly and sparsely punctate, intervening surface polished. Antennæ of moderate length, distinctly incrassate, joints five to 10 inclusive, slightly serrate and somewhat asymmetrical, ninth and tenth transverse, eleventh short oboval, distinctly flattened and scarcely longer than wide.

Pronotum noticeably transverse, about a half wider than long, moderately and evenly convex from side to side, widest behind the middle; apex feebly arcuate in moderate circular arc; sides more strongly arcuate posteriorly and slightly convergent and feebly rounded to apex; base broadly arcuate; angles rounded; disk sparsely and distinctly punctate, punctures separated by a distance equal to one to three times their diameter, surface polished throughout.

Elytra about twice as long as wide, almost evenly convex from side to side, but more strongly declivous behind the humeri in basal half, quite broadly and conjointly rounded at apex; punctures less distinct than on pronotum, becoming somewhat smaller toward apex, usually separated by a distance equal to two or three times their diameter; humeri rounded and feebly tumid.

Measurements: Length (type) 3.5 mm.; width 1.4 mm.

Holotype, female in the author's collection. It was taken on June 3, 1922. I am indebted to Mr. Warwick Benedict for the two specimens, both females, that I possess.

Type locality: Riverside, Riverside County, California.

T. gradatus is more elongate and less robust than *seriellus* Casey, after which it is to be placed in our lists according to Casey's table. I am indebted to Col. Casey for a typical example of *seriellus* collected in Utah. *T. fuscus* is a very robust and a distinctly different species from *gradatus.* The other related species given in Casey's synopsis have red legs. In *pruinosus* long stiff black hairs occur on the pronotum; in *gradatus* the head and pronotum are devoid of erect hairs. The male characteristics are not known.

6. **Trichochrous pallescens** Blaisdell, new species

Form oblong, moderately convex, slightly narrowing anteriorly, a little more than twice as long as wide. Color testaceous; head, prothorax, sterna and abdomen toward base, more or less piceous; surface somewhat shining. Pubescence pale fulvous, moderately dense, not short, recumbent; long, sparse and bristling hairs on head and pronotum, those on the elytra semi-erect, not very evident in the central area of the disk, but distinct laterally, basally and over apex. Pronotal fimbriæ not forming a close-set fringe, but long and bristling, as are those of the elytra.

Head about as long as wide, eyes moderately large but not prominent; front very slightly convex, nearly glabrous along the median line, sparsely and distinctly punctate laterally; surface not noticeably impressed; muzzle moderate, about as long as wide at base and subparabolic in outline. Antennæ short, scarcely attaining the middle of the pronotal disk, moderately stout, joints five to 10 inclusive strongly serrate and asymmetric, second oval and about as long as wide.

Pronotum about as long as wide to about a fourth wider, quite evenly and rather strongly convex from side to side; apex slightly arcuate in moderate circular arc; sides moderately arcuate, widest just behind the middle and noticeably convergent and less arcuate anteriorly to apex; apical angles obtusely rounded; base broadly and evenly arcuate, continuously so with the sides; disk evenly punctate, punctures well defined and separated by a distance equal to two to four times their diameter, with the intervening surface smooth throughout.

Elytra oblong, scarcely twice as long as wide, sides parallel, slightly depressed on dorsum; base feebly emarginate, humeri slightly tumid; disk rather closely and moderately finely punctate; punctures separated by a distance equal to one or two times their diameter.

Abdomen and sterna finely punctate. Legs moderate in length and stoutness.

Male a little less stout; antennæ quite stout and serrate; fifth ventral abdominal segment feebly sinuate in middle third of the apex with surface slightly flattened. Female slightly broader; antennæ rather less stout; fifth ventral only moderately arcuate in middle of apex with the margin slightly deflexed.

Measurements: Length (types) 3-3.3 mm.; width 1.3-1.4 mm.

Holotype, male, and *paratypes* in the author's collection.

Allotype, female, No. 1569, and a female *paratype,* in the collection of the California Academy of Sciences.

Type locality: Palm Springs, Riverside County, California, collected on May 20, 1916. A series of nine specimens has been studied. I have examined specimens taken at Riverside, California, collected June 3, 1922, kindly contributed by Mr. Warwick Benedict of Santa Monica, California. In some specimens the elytra at base and along the suture may be more or less piceous. *T. pallescens* should precede *fulvescens* in our lists. It differs from the latter species in its pale antennæ and legs; the pubescence is entirely pale.

7. **Dasytastes leopardus** Blaisdell, new species

Form somewhat elongate, suboval, slightly narrowed anteriorly, moderately convex, feebly depressed dorsally. Color black; legs more or less testaceous, upper surface of femora fuscous, tarsi black to nigro-piceous; the tibial apices sometimes fuscous. Antennæ black, paler at base, first two joints usually testaceous; mouth-parts pale; surface dull. Pubescence dense throughout, relatively short and fine, closely decumbent and cinereous in color, the elytra maculate with small inconspicuous patches of blackish hairs; devoid of erect hairs; fimbriæ short and cinereous; pronotal apex fimbriate.

Head small, oval and feebly transverse, muzzle extremely short, eyes somewhat prominent and relatively moderate in size, evenly convex; front broadly and very feebly impressed, most strongly so just behind the epistoma and between the rather prominent supra-antennal convexities; pubescence moderately long, obscuring the very fine punctuation. Antennæ slender, quite long, extending beyond the pronotal base, very feebly incrassate; eleventh joint widest and subfusiform, second twice as long as wide, third subcylindrical and slender, fourth triangular (isoscelis), fifth subtriangular and as long as wide; other joints subequal and similar in form.

Pronotum about a fourth wider than long, rather strongly and evenly convex; apex subtruncate in nearly circular arc; sides broadly but not strongly arcuate, margin finely and irregularly serrulate; apical angles obtusely rounded; base broadly arcuate, continuously so with the sides, slightly irregular at the obsolete angles; disk very finely and obscurely punctate.

Elytra oblong-oval, about three-fourths longer than wide, sides subparallel, broadly arcuate posteriorly with the broadly rounded apex, apical margins serrulate; disk rather broadly convex from side to side, slightly flattened across base and in the central area, very broadly and gradually declivous apico-laterally, finely punctate, punctures not distinct; humeri somewhat tumid. Under surface of the body finely and rather densely sculptured. Legs relatively slender and of moderate length.

Male usually smaller, narrower and more parallel than the female; antennæ slightly stouter; fifth ventral abdominal segment arcuato-truncate at apex. Female broader, suboval; fifth ventral rather broadly arcuate at apex.

Measurements: Length (types) 2-2.4 mm.; width .8-1 mm.

Type: Male, No. 1570, and *allotype,* female, No. 1571, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, April 7, 1923, at **Potholes, Imperial Co., California.** *Paratypes* in the Academy collection and in that of the author.

Taken on mesquite and Encelia. *T. leopardus* is a very distinct and pretty species. It resembles *vanduzeei* Blais., except in color, *vanduzeei* being fulvo-testaceous; both species have the elytra maculate; *maculatus* described below is larger, more parallel and oblong.

8. **Dasytastes maculatus** Blaisdell, new species

Form elongate, oblong-oval, elytra distinctly parallel, head and prothorax slightly narrower than the elytra, moderately convex, but slightly flattened on the elytral disk, about 1½ times longer than wide, similar in the sexes. Color black; legs testaceous, the tarsi and tibiæ sometimes nigrescent. Antennæ usually pale at base, second and third joints testaceous, sometimes black or piceous throughout. Mouth-parts pale or piceous. Luster dull. Pubescence plumbeo-cinereous in color, dense, fine, somewhat short; elytra irregularly mottled with small and more or less inconspicuous patches of dark hairs. Pronotal and elytral fimbriæ very short and cinereous.

Head moderately transverse, eyes large and quite prominent, strongly convex; muzzle broad and very short; front very broadly and feebly impressed, sparsely, finely, quite regularly and distinctly punctate; sculpturing more or less obscured by the pubescence; supra-antennal convexities not evident, sides simply reflexed. Antennæ long and rather slender, slightly compressed beyond the third joint, joints proportioned as in *leopardus*.

Pronotum about a third wider than long, quite strongly convex, especially from side to side; apex truncato-arcuate in nearly circular arc; sides strongly and rather prominently arcuate behind the middle, less so and slightly convergent anteriorly, posteriorly oblique and somewhat sinuate to the scarcely evident angles, margin finely serrulate; apical angles rather narrowly rounded; base broadly arcuate, almost continuously so with the sides; disk rather strongly declivous antero-laterally, rather broadly impressed within the basal angles so that the margin appears slightly explanate; punctures fine, quite distinct, rather closely placed, separated by a distance equal to about two to four times their diameter.

Elytra oblong, slightly less than twice as long as wide, parallel, broadly rounded at apex, apical margin serrulate; humeri tumid, surface impressed within; base wider than pronotal base; disk moderately convex from side to side, less so on the central area and at base, very gradually declivous apico-laterally, punctures fine, rather close and not very distinct.

Abdomen and anterior parts beneath, finely and quite densely sculptured. Legs relatively very moderate in slenderness and length.

Male with antennæ a little stouter. Abdominal segments two to four quite equal in length, fifth but slightly longer than the fourth and broadly arcuate, scarcely subtruncate at apical and middle thirds. Female with antennæ rather slender. Fifth ventral distinctly longer than either of the three preceding and subequal segments, sides obliquely arcuate, convergent, apex not broadly rounded, surface at apical margin subasperate.

Measurements: Length (types) 2.6-2.8 mm.; width 1.1-1.2 mm.

Holotype, male, and two female *paratypes* in the author's collection. *Allotype,* female, No. 1572, in the collection of the California Academy of Sciences. Four specimens collected in May, by Dr. A. Fenyes.

Type locality: Mojave, California.

D. maculatus in general appearance resembles *leopardus,* from which it differs in being larger, more parallel and oblong, with less difference between the sexes as regards body form, head broader, eyes larger and more convex, and several other characters are recognizable. The species of Dasytastes may be divided into three groups, each with distinctive characters, namely: the *catalinæ, ruficollis* and *vanduzeei* groups.

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XVIII

THE OPHIURANS OF MONTEREY BAY[1]

BY

RAOUL MICHEL MAY

I. INTRODUCTION

Very little work has been done on the ophiurans of California. McClendon (1909) published a résumé of the species of the San Diego region. H. L. Clark (1911), in his fine paper on the North Pacific Ophiurans, included many species which occur in California. Busch (1918-1921) listed the species of Friday Harbor, Washington. Species described in all three of these papers occur in Monterey Bay. Outside of them, however, excluding a few occasional papers in which species from this locality are listed or described indirectly, no study has ever been made of the ophiurans of Monterey Bay. This bay is peculiarly situated in that here species representative of both the north and the south are found.

The present paper is based on (1) the collections made by the U. S. Fisheries Steamer Albatross in Monterey Bay in 1904; (2) specimens collected at divers times and by different persons working at the Hopkins Marine Station of Stanford University; and (3) specimens collected by the writer in the summer of 1921.

Of the 24 species which have been collected in Monterey Bay, seven are intertidal, while 17 have been secured only

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[1] Contribution from the Hopkins Marine Station of Stanford University.

November 21, 1924

from dredgings. Of the seven littoral species, only two have never been collected beyond the low tide level.

The 23 identified species are grouped into 15 genera, and eight families. The keys are artificial, and apply only to the species in Monterey Bay.

As the average collector will most likely come in contact only with the intertidal species, a key is given by which those forms which occur above the low tide level can be identified. The key is artificial and applies only to the littoral species.

The coloration of the living animals is given whenever possible. That of the intertidal species was made by the writer, and that of the dredged forms by Dr. W. K. Fisher, who accompanied the Albatross on her 1904 cruise.[2]

Alphabetical List of the Ophiurans of Monterey Bay

1. *Amphilimna pentacantha*
2. *Amphiodia occidentalis*
3. *Amphiodia periercta*
4. *Amphiodia urtica*
5. *Amphipholis pugetana*
6. *Amphiura arcystata*
7. *Amphiura seminuda*
8. *Asteroschema sublaeve*
9. *Asteronyx loveni*
10. *Gorgonocephalus eucnemis*
11. *Ophiacantha diplasia*
12. *Ophiacantha eurypoma*
13. *Ophiocten culveri*
14. *Ophiocten hastatum*
15. *Ophionereis eurybrachyplax*
16. *Ophionereis sp.* (*young*)
17. *Ophiopholis aculeata* forma *kennerlyi*
18. *Ophiopholis bakeri*
19. *Ophiopholis longispina*
20. *Ophioplocus esmarki*
21. *Ophiopteris papillosa*
22. *Ophiothrix spiculata*
23. *Ophiura leptoctenia*
24. *Ophiura lutkenii*

Ecology of the Littoral Forms

Due no doubt to the extreme fragility of ophiurans, the littoral forms are only found in well sheltered spots, where they are protected from the full impact of the waves by rock formations. The species, furthermore, segregate themselves in particular ecological surroundings.

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[2] Dr. Fisher used Ridgway's (1886) Nomenclature of Colors, while the writer had the improved (1912) Color Standards and Nomenclature.

I take great pleasure in expressing my gratitude to Dr. W. K. Fisher who suggested this study to me, and under whose guidance the work was carried on, and to Dr. H. L. Clark, who kindly went over the manuscript and suggested some changes, while allowing me full access to the rich collection of ophiurans in the Museum of Comparative Zoölogy at Cambridge, Massachusetts.

A set of specimens will be deposited in the California Academy of Sciences' collection.

Ophiopteris papillosa is found under rocks, on a rocky base, pretty well out on the low tide level. It is the most active of the littoral forms, scampering away very quickly when its protecting rock is overturned. It possesses a remarkable power of autotomy, and will break its arms at their base very readily. Specimens are usually found together. Two or three may be under the same rock. It is fairly common.

Ophiopholis aculeata forma *kennerlyi* is found in about the same situations as Ophiopteris. It is much less active, and makes only slow movements when uncovered. I have never seen one break its arms, and it seems to be unusually lacking in the power of autotomy. It is a rather uncommon species.

Ophiothrix spiculata is found under rocks on a rocky bottom or on some alga, such as Ulva, in very secluded spots. When on Ulva, it seems to lie perfectly inactive, and lets itself be moved by the "va et vient" of the water. It shows remarkable diversity in its coloring. When much disturbed it breaks its arms occasionally, usually at the base. Although not as active as Ophiopteris, it will try to escape when annoyed. It is rather common.

Ophioplocus esmarki is found under flat rocks, on a rocky or sandy bottom. It is very sluggish, much more so than Ophiopholis. When disturbed, it simply lies in the same position, moving only the tips of the arms. It is fairly common.

Amphiodia occidentalis always is found on or in sand, under rocks, under broken Mytilus shells, or in the roots of Phyllospadix. Many specimens are usually found together, often in great numbers, and many times associated with *Amphipholis pugetana.* One may get many specimens by digging under rocks, in the sand. One finds Amphiodia a few inches below the surface of the sand, and many times one or several of its arms may project to the outside. It is fairly active, but moves its very long arms in an aimless way. This species is extremely common, and, due to its being protected by the sand, may be found in situations where no other ophiurans exist.

Amphipholis pugetana is found on Ulva, in Macrocystis holdfasts, among the roots of Phyllospadix, and under rocks on sandy and rocky bottom. It never digs below the surface of the sand like Amphiodia. It is constantly in motion, but rather slowly. It is exceedingly common, and is perhaps the most abundant littoral form.

I found one young Ophionereis under a rock, on sandy bottom, at low tide. It was not very active, but made slow movements of the arms. This was the only representative of the species which I collected.

ECOLOGICAL TABLE

On Ulva—Ophiothrix, Amphipholis
In roots of Phyllospadix—Amphipholis, Amphiodia
In Macrocystis holdfasts—Amphipholis, Amphiodia
On sand—Amphipholis, Amphiodia
Under rocks
    a. On rocky bottom—Ophiopteris, Ophiopholis, Ophiothrix, Ophioplocus, Amphipholis.
    b. On sandy bottom—Ophioplocus, Ophionereis, Amphiodia, Amphipholis.
In sand—Amphiodia

Ophioplocus esmarki and the young Ophionereis are the only species that have not been collected beyond the low tide level.

EXPLANATION OF TERMS

Adoral plates	Two plates at the base of the jaws, proximal to the oral shield.
Arm comb	A series of small scales on the upper side of the arm, distal to the disk, as in the genus Ophiura.
Arm spines	Spines borne on the side arm plates (fig. 1, *a. s.*).
Dental papillæ	Small projections under the teeth, at apex of jaw.
Disk	The body as distinguished from the arms, especially the aboral side.
Distal	Away from the mouth.
Genital slit	The openings of the genital bursæ, at the sides of the arms, in the interbrachial areas.
Genital scales	Scales bordering the genital slits.
Jaws	The five triangular bodies which surround the mouth, each made up of several plates, and bearing the dental and oral papillæ.
Interbrachial areas	The disk as differentiated from the arms on the oral side.
Oral papillæ	Tooth-like projections on the sides of the jaws.

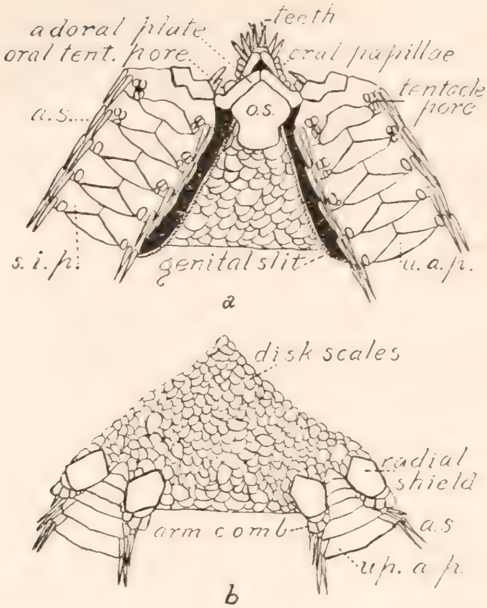

Fig. 1. Ophiura lütkenii, X3.2.—a, from below; b, from above. *A. s*, arm spines; *o. s.*, oral shield; *s. i. p.*, side arm plates; *u. a. p.* and *up. a. p*, under and upper arm plates.

Oral shield..........	Large plates, lying between the arms, singly, distal to the mouth (fig. 1, *o. s.*).
Primary plates......	1 dorso-central, 5 radial, 5 interradial plates, distinguished by their greater size, arranged symmetrically on aboral side of disk, but often distinguishable in adults.
Proximal...........	Towards the mouth.
Radial shields.......	Two large plates, at base of each arm on aboral side of disk. (Not always visible).
Side arm plates......	A series of plates, along each side of the arm (fig. 1, *s. i. p.*).
Supplementary plates	Small plates sometimes present on the sides of the upper arm plates, as in Ophiopholis, and Ophionereis.
Tentacle pores......	Openings on the sides of the jaw and under arm plates, through which tentacles project in the living animal.
Tentacle scales......	Small scales bordering the tentacle pores.
Under arm plates....	A series of plates on the under side of the arms (fig. 1, *u. a. p.*).
Upper arm plates....	A series of plates on the upper side of the arms (fig. 1, *up. a. p.*).

II. DESCRIPTION OF SPECIES

1. ARTIFICIAL KEY TO THE FAMILIES AND GENERA OF OPHIURANS IN MONTEREY BAY

I. Disk and arms covered by a skin; arms capable of being bent toward the mouth; dorsal arm plates absent or very rudimentary.
  a^{1}. Arms simple . . . . I. Trichasteridæ
    b. Disk above and radial shields granulated; arms not very long and whip-like . . . . 1. *Asteroschema*
    bb. Disk above and radial shields naked; arms very long and whip-like . . . . 2. *Asteronyx*
  a^{2}. Arms branched . . . . II. Gorgonocephalidæ
    Disk and radial shields nearly bare or minutely granulated; genital slits begin at about middle of interbrachial space . . . . 3. *Gorgonocephalus*

II. Disk and arms not covered by thick skin; arms not capable of being vertically coiled; dorsal arm plates present.
  a^{1}. Side arm plates meeting both above and below; no dental papillæ; long arm spines . . . . III. Ophiacanthidæ
      Disk plates above hidden or nearly hidden by granules 4. *Ophiacantha*
  a^{2}. Side arm plates not meeting both above and below.
    b^{1}. Oral papillæ absent . . . . IV. Ophiothricidæ
        Disk beset with spines; spine-like tentacle scale . . . . . 5. *Ophiothrix*
    b^{2}. Oral papillæ present.
      c^{1}. No vertical clump of dental papillæ; arms inserted on ventral side of disk; arm spines at strong angle with arm; supplementary plates, when present, more than two, and surrounding upper arm plates . . . . V. Amphiuridæ
        d^{1}. Supplementary plates surrounding upper arm plates . . . . 6. *Ophiopholis*
        d^{2}. No supplementary plates
          e^{1}. Disk beset with spines . . . . 7. *Amphilimna*
          e^{2}. Disk bare.
            f^{1}. Oral papillæ two on a side; first oral tentacle scale appears like third oral papilla; interbrachial spaces bare in Monterey Bay species . . . . 8. *Amphiura*
            f^{2}. Three oral papillæ on a side; interbrachial spaces scaly.
              g^{1}. Oral papillæ subequal . . . . 9. *Amphiodia*
              g^{2}. Distal oral papilla much longer than other two . . . . 10. *Amphipholis*
      c^{2}. Arms inserted in a definite cleft in the disk; arm spines parallel with arm and closely appressed to it . . . . VI. Ophiolepididæ
        d^{1}. Notch at edge of disk on upper side, where arms meet disk . . . . 11. *Ophiura*
        d^{2}. No notch at edge of disk.
          e^{1}. Upper arm plates entire; radial shields large . . 12. *Ophiocten*
          e^{2}. Upper arm plates broken up into small plates; radial shields very small . . . . 13. *Ophioplocus*

c^3. Arm spines at angle with arm; disk free of granules; supplementary plates one on either side of upper arm plate. . VII. Ophiochitonidæ

Tentacle scale single, large.................. 14. *Ophionereis*

c^4. Dental papillæ well developed; disk covered with granules.... .... VIII. Ophiocomidæ

Arm spines flat, blunt...................... 15. *Ophiopteris*

c^5. Arm spines at angle with arm. No supplementary plates; disk bare; differs from Amphiuridæ, as keyed, in very small and inconspicuous radial shields, whereas Amphiuridæ with bare disks have large and conspicuous radial shields.................. 16. *Ophionereis*, juv.

KEY TO THE LITTORAL SPECIES

a^1. Disk granulated above.

b^1. Supplementary plates bordering upper arm plates; small spines on interbrachial areas........................ *Ophiopholis aculeata* f. *kennerlyi*

b^2. No supplementary plates; interbrachial areas with small stumps or granules.. *Ophiopteris papillosa*

a^2. Disk not granulated.

b^1. Oral papillæ absent.......................... *Ophiothrix spiculata*[3]

b^2. Oral papillæ present.

c^1. Upper arm plates divided into smaller plates; disk very flat.... .... *Ophioplocus esmarki*

c^2. Upper arm plates not divided.

d^1. Two small tentacle scales; radial shields conspicuous; three oral papillæ on each side of jaw.

e^1. Oral papillæ subequal; arm spines flat and blunt..... .... *Amphiodia occidentalis*

e^2. Distal oral papilla much longer than other two; arm spines terete and sharp.................. *Amphipholis pugetana*

d^2. One large tentacle scale; radial shields inconspicuous, about a large as disk scales; four oral papillæ on each side of jaw .... *Ophionereis* sp, juv.

Family I. TRICHASTERIDÆ

Genus **Asteroschema** Lütken

Asteroschema Lütken, 1856, Vid. med., p. 16.

Disk small, covered with granulated skin. Arms long and thin, covered with granulated skin that hides all plates. Genital slits small, almost vertical. Under arm plates pushed inside the arms; side arm plates joining ventrally, and extending only slightly onto lateral faces. Two tentacle scales. No dental papillæ, no oral papillæ. A vertical series of teeth.

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[3] H. L. Clark (1915a), in his "Catalogue of Recent Ophiurans", lists *Ophiothrix dumosa* as occurring at Pacific Grove.

I have examined the specimens classified as *Ophiothrix dumosa*, some of them from Pacific Grove, California, in the Harvard Museum of Comparative Zoölogy at Cambridge, Massachusetts. This study has convinced me that *Ophiothrix dumosa* is synonymous with *Ophiothrix spiculata*, and that the specimens originally described by Lyman in 1860 were one of the many variations which occur in *Ophiothrix spiculata*. In this opinion Dr. H. L. Clark fully agrees with me. I shall speak of this matter more at length under "*Ophiothrix spiculata*".

1. **Asteroschema sublæve** Lütken & Mortensen

Asteroschema sublæve Lütken & Mortensen, 1899, Mem. M. C. Z., 23, p. 187, pl. 22, f. 13, 14.

Disk diameters ranging from 13 to 16 mm. Arms naked below, or with very flat, scale-like particles, unlike granules, on sides of arms, and dorsal side of arms and disk; arm spines mostly two; in middle of arm the inner one is elongated, club-shaped.

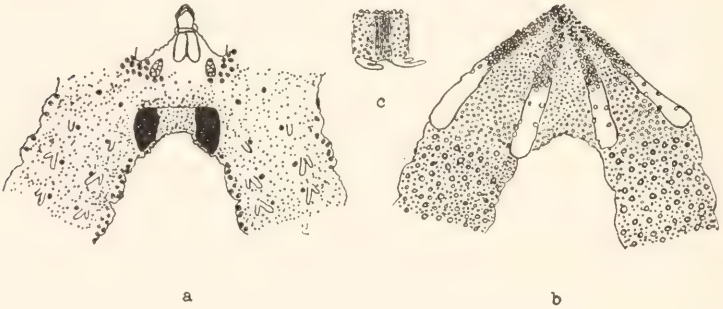

Fig. 2. Asteroschema sublæve, X2.5.—a, from below; b, from above; c, side view of two arm joints near disk.

My specimens show variations in (1) the presence or absence of tubes, made up of small scales, around the first tentacle; (2) the number of granules on the disk between the ribs, on the aboral side.

The tubes may be about 1 mm. long, as in the figure; they may be half of that, or they may not be present at all. The granulation may be almost as thick as on the ribs, or it may vary to nakedness on some segments of the disk.

Color in life. Aboral surface: Arms Chinese orange (scarlet vermilion+cadmium orange+burnt sienna). Disk orange in center, purplish between ribs. Oral surface: Papillæ of arms entire light or dark brown. Space between two bursal openings brown. Some specimens more deeply colored than others.

SPECIMENS OF ASTEROSCHEMA SUBLÆVE EXAMINED.—Six.

Station 4530, Point Pinos Light House, S. 78° E., 6.8 miles, 847-755 fathoms, soft gray mud, 4 specimens.

Station 4537, Point Pinos Light House, S. 74°E., 7.4 miles, 1062-861 fathoms, hard sand, mud, 2 specimens.

Bathymetrical range, 755 to 1062 fathoms.

Genus **Asteronyx** Müller & Troschel

Asteronyx Müller & Troschel, 1842, Syst. Ast., p. 85, 119.

Arms unbranched. The edges of the jaws are beset with sharp papillæ. No true teeth. The tentacle pores are bordered by hooks (tentacle scales).

2. **Asteronyx loveni** Müller & Troschel

Asteronyx loveni Müller & Troschel, 1842, Syst. Ast., p. 119, pl. 10, f. 3-5.

Disk naked, as well as arms. Arms long and whip-like. In each interbrachial space, in the proximal corner, lies a deepening, into which open the genital slits on either side. My specimens range in disk diameters from 5 to 45 mm.

Color in life. Aboral surface of arms saturn red (scarlet vermilion + cadmium orange); disk flame scarlet, brighter toward center; apical region between inner tips of ridges rich deep carmine. Oral surface of arms much paler; interbrachial area bluish toward center; oral tentacles deep rich vermilion; tentacle feet slightly darker than aboral surface.

Asteronyx loveni is usually associated with the pennatulid, *Balticina pacifica,* around the upper part of the stem of which it twines its arms. Dr. W. K. Fisher informs me that as near as he can recall practically all the specimens collected were found on tall, slender pennatulids.[4]

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[4] At station 4530 the net came up with a sheaf of tall, slender, purplish pennatulids. Each pennatulid carried one to several bright reddish-orange Asteronyx—a truly gorgeous combination of color. Note by W. K. Fisher.

SPECIMENS OF ASTERONYX LOVENI EXAMINED.—
One hundred seventy-three.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4442	Point Pinos Light House S. 67° W., 4.6 miles..............	26–31	fine gray sand....	1
4443	Point Pinos Light House, S. 69° W., 3.7 miles..............	32–37	fine gray sand....	1
4513	Point Pinos Light House, S. 31° E., 9.3 miles..............	456–389	green mud.......	4
4514	Point Pinos Light House, S. 39° E., 10.7 miles.............	406–394	green mud, rock..	2
4515	Point Pinos Light House, S. 18° E., 8.1 miles..............	495–198	green mud, coarse sand, shells....	1
4516	Point Pinos Light House, S. 49° E., 12.5 miles.............	756–718	green mud.......	4
4530	Point Pinos Light House, S. 78° E., 6.8 miles..............	847—755	soft gray mud....	108
4537	Point Pinos Light House, S. 74° E., 7.4 miles..............	1062–861 [5]	hard sand, mud..	3
4538	Point Pinos Light House, S. 85° E., 6.5 miles.............	871–795	hard gray sand...	48
4547	Point Pinos Light House, S. 82° E., 10.5 miles.............	1083	gray mud, rock...	1

Bathymetrical range, 26 to 1083 fathoms.

Family II. GORGONOCEPHALIDÆ

Genus **Gorgonocephalus** Leach

Gorgonocephalus Leach, 1815, Zool. misc., 2, p. 51.

Arms branching. Genital slits at the external portion of the interbrachial spaces. Long styliform ribs. No real arm spines, but tentacle scales. Teeth, dental papillæ, and oral papillæ, all similar, spiniform.

3. **Gorgonocephalus eucnemis** Müller & Troschel

Astrophyton eucnemis Müller & Troschel, 1842, Syst. Ast., p. 123.

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[5] Bottom temperature 38.5° Fahr.

Gorgonocephalus eucnemis Döderlein, 1900, Echinod. Olga-exp., p. 226, pl. 10, f. 1-4.

Disk and ribs very minutely granulated. Tentacle scales (arm spines) mostly three. Genital slits, beginning at distal portion of interbrachial spaces, rather wide.

Color in life. Aboral surface: Ribs of disk rufous; interspaces maroon; arms cinnamon rufous, barred with vinaceous cinnamon. Oral surface: Salmon buff; interbrachial areas rather deep ferruginous.

My specimens range in disk diameters from 9 mm. to 90 mm., making *Gorgonocephalus eucnemis* the largest Ophiuran in Monterey Bay.

One specimen from station 4543 was brought up attached to the gorgonian, *Psammogorgia arbuscula.* This specimen had a disk diameter of 9 mm. and was but slightly branched.

Gorgonocephalus eucnemis is commonly called "basket-star", by the fishermen of Monterey Bay.

SPECIMENS OF GORGONOCEPHALUS EUCNEMIS EXAMINED.—Five[6]

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4439	Point Pinos Light House, S. 38° W., 1.5 miles..............	42–40	gray sand, shells..	1
4441	Point Pinos Light House, N. 87° W., 1.7 miles..........	35–28	blue mud, sand, shells.........	1
4518	Point Pinos Light House, S. 42° E., 5.7 miles..............	76–66	hard sand.......	1
4543	Point Pinos Light House, S. 25° E., 5.4 miles..............	93–53	hard sand, rock...	1
4551	Point Pinos Light House, S. 9° E., 4.5 miles..............	56–46	coarse sand, shells, rock..........	1

Bathymetrical range, 28 to 93 fathoms.

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[6] This species is common on appropriate bottom, at about 40 to 70 fathoms. W. K. F.

Family III. OPHIACANTHIDÆ

Genus **Ophiacantha** Müller & Troschel

Ophiacantha Müller & Troschel, 1842, Syst. Ast., p. 84, 106.

Disk thick, covered by a skin bearing spines or granules, partly or completely hiding the imbricated scales of the disk. No dental papillæ; teeth; seven to 16 long oral papillæ. Four to 11 arm spines on either side arm plate; side arm plates nearly or completely meeting above and below.

ARTIFICIAL KEY TO THE SPECIES OF OPHIACANTHA

Distal oral papilla same thickness as others; disk closely granulated, so that no scales are seen.......................................*O. diplasia*

Distal oral papilla much thicker than the others; underlying scaling seen more or less under granules.............................*O. eurypoma*

4. **Ophiacantha diplasia** H. L. Clark

Ophiacantha diplasia H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 209, f. 97.

Disk diameters ranging from 12 mm. to 25 mm. Disk closely covered with coarse, nearly spherical granules. On interbrachial spaces, the granules are elongated and pointed;

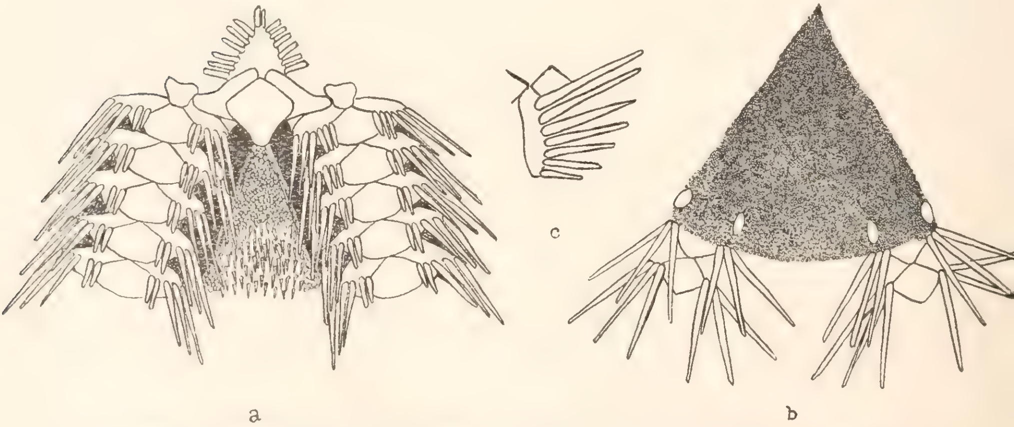

Fig. 3. Ophiacantha diplasia, X4.1.—a, from below; b, from above; c, side view of an arm joint near disk.

they cover the interbrachial spaces more or less. Oral papillæ five to seven on a side, long, narrow, subequal. Arm spines seven or eight on each side, long, hollow; uppermost spine longest. Tentacle scales two on each pore, long, flat, and blunt. Color (dried from alcohol). Disk, brown of some shade, ranging from very light to very dark. Arms and arm spines usually much lighter than disk and often nearly white; occasionally the disk is dark brown, mottled with a lighter shade.

SPECIMENS OF OPHIACANTHA DIPLASIA EXAMINED.—Thirty-two.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4551	Point Pinos Light House, S. 9° E., 4.5 miles.	56–46	coarse sand, shells, rock	2
4552	Point Pinos Light House, S. 73° E., 4 miles.	73–66	green mud, rock . .	3
4554	Point Pinos Light House, S. 76° E., 3 miles.	60–80	green mud, rock . .	20
4555	Point Pinos Light House S. 63°, E., 3.4 miles.	66–69	green mud, rock . .	7

Bathymetrical range, 46 to 80 fathoms.

5. **Ophiacantha eurypoma** H. L. Clark

Ophiacantha eurypoma H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 223, f. 103.

Disk diameters ranging from 6 mm. to 17 mm. Disk covered with stumps which are more or less rubbed off, leaving underlying scaling bare. Oral papillæ three on a side, and one at apex of jaw. The distal papilla is wide, squarish, while the others are narrow and long. Arm spines seven or eight, lowest smooth, next spines slightly thorny, upper spines smooth. Tentacle scale single, large, flat, blunt.

Color in life. Aboral side of disk: Radial shields and vicinity light yellowish vinaceous cinnamon; center of disk and ten radiating lines heliotrope purple; arms, vinaceous cinnamon, spines light vinaceous rufous. Oral side. Interbrachial area yellowish; arms flesh color.

November 21, 1924

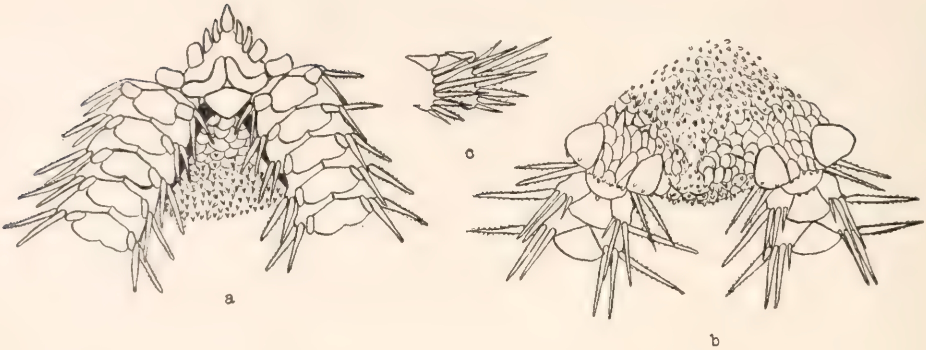

Fig. 4. Ophiacantha eurypoma, X3.6.—a, from below; b, from above; c, side view of two arm joints near disk.

SPECIMENS OF OPHIACANTHA EURYPOMA EXAMINED.—Forty-four from Station 4537, Point Pinos Light House, S. 74° E., 7.4 miles, 1062 to 861 fathoms, hard sand, mud.

Family IV. OPHIOTHRICIDÆ

Genus **Ophiothrix** Müller & Troschel

Ophiothrix Müller & Troschel, 1840, Arch. Naturg., 6, p. 238.

Disk set with thorny grains or thorny spines. Radial shields large, triangular, swollen. Numerous crowded dental papillæ forming a vertical oval. Teeth. No oral papillæ. Five to 10 arm spines often three times as long as the arm joints. Usually a small, spine-like tentacle scale. The base of the jaw pierced with a hole. Interbrachial spaces swollen. Two genital slits, opening outside the oral shield. Outer arm joints with hooks.

6. **Ophiothrix spiculata** Leconte

Ophiothrix spiculata Leconte, 1851, Proc. Acad. Nat. Sci., Phila., 5, p. 318. McClendon, 1909, Univ. Calif. Publ. Zool., 6, pl. 6, f. 38, 39.

Ophiothrix dumosa Lyman, 1860, Proc. Boston Soc. Nat. Hist., 7, p. 252. 1865, Mem. Mus. Comp. Zool., Harvard, p. 169.

Disk diameters ranging between 2 mm. and 15 mm; disk, including radial shield, variably covered with thorny spines. Dental papillæ in a linear vertical oval, with a vertical row in the middle. One small tentacle scale. Seven long serrated arm spines; the second or third is the longest.

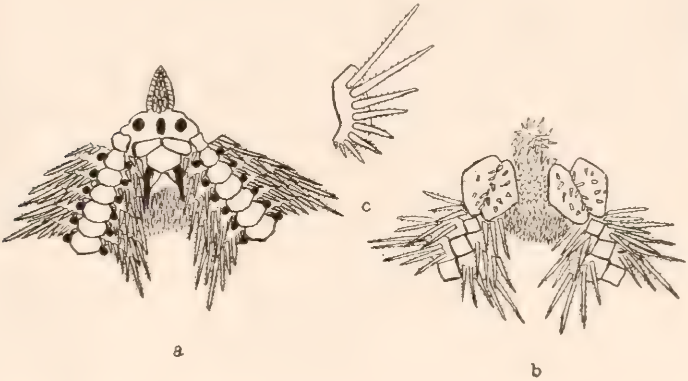

Fig. 5. Ophiothrix spiculata, X3.4.—a, from below; b, from above; c, side view of an arm joint near disk.

Color in life. Remarkable variation is seen here, and a great many different patterns are present. Aboral side of disk: Hessian brown, sepia, or dark greenish olive; or garnet brown spots on dark cress green background; or dark red with irregular gray and brown mottlings; or dark olive blue; or light olive. Arms: Olive citrine, crossed by reddish bands about every two plates, the bands being one plate wide; or dark greenish olive, spines tipped with pink; or light olive, with red cross-bands; or garnet brown spots on dark cress green background; or dark red mottled irregularly with gray and brown. Oral side: Interbrachial spaces and arms white near mouth. Interbrachial spaces zinc orange; or light olive; or gray; or dark olive. Ventral side of arms: Castor gray with reddish cross bands every two plates; or yellowish olive with cross bands of Dragon's blood red every three plates, covering one plate; or gray with light red bands; or light olive with cross bands of light red; or dark yellow crossed by light red bands.

As noted above, *Ophiothrix dumosa* is reported from Pacific Grove. Lyman (1865 p. 170) says of *Ophiothrix dumosa:*

"This species might be called a coarse edition of *Ophiothrix spiculata*, from which it is distinguished chiefly by the armature of the disk, which is coarser, and of a different character; the arm-spines, also, are rather stouter, and the under arm-plates more regular and angular." He also states (1865, p. 168) that *Ophiothrix spiculata* is "remarkable as a variable species".

Lyman erected *Ophiothrix dumosa* on the basis of a small series of specimens. He doubtless did not examine specimens in the field, and, although aware of the variability of *Ophiothrix spiculata*, was not cognizant of its full capacity for variation.

A careful study of the collection at the Museum of Comparative Zoölogy, has convinced me that *Ophiothrix dumosa* is simply one of the variants of *Ophiothrix spiculata*, and must be accepted as synonymous with the latter species. The differences between *Ophiothrix dumosa* and *Ophiothrix spiculata* are certainly much less than occur among any large series of specimens of *Ophiothrix spiculata*.

SPECIMENS OF OPHIOTHRIX SPICULATA EXAMINED.—
One hundred fifty-five.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4439	Point Pinos Light House, S. 38° W., 1.5 miles	42–40	gray sand, shells	1
4441	Point Pinos Light House, N. 87° W., 1.7 miles	35–28	blue mud, sand, shells	7
4496	Santa Cruz Light House, N. 80° W., 2.1 miles	10	fine gray sand, rock	1
4532	Point Pinos Light House, N. 76° E., 2.3 miles	30	gray sand, rock	1
4558	Point Pinos Light House, S. 79° W., 2 miles	40–28	rock	4
	Off Del Monte	10–15		30
	Off Del Monte, June, 1906	10–15	blue mud	96
	Monterey			2
	Pacific Grove, 1921	Low tide	rocky	13

Bathymetrical range, low tide to 42 fathoms.

Family V. AMPHIURIDÆ

Genus **Ophiopholis** Müller & Troschel

Ophiopholis Müller & Troschel, 1842, Syst. Ast., p. 96.

Disk more or less covered with grains or spinules. No dental papillæ; oral papillæ on the sides of the mouth frames. Arm spines short, flat, and stout; upper arm plates surrounded by a rim of supplementary pieces; the lowest spine of the distal arm joints is a hook. General structure coarse and stout. Two genital openings beginning outside the oral shields.

KEY TO THE SPECIES OF OPHIOPHOLIS

Supplementary pieces few (six to 10 to each upper arm plate), large, angular, and crowded; arm spines short, rarely equal to a joint; disk with granules .... *O. aculeata* f. *kennerlyi*
Supplementary pieces very small, granule-like, commonly not in contact.
  Radial shields and disk more or less covered by slender spines; arm spines moderately long .... *O. bakeri*
  Radial shields large and bare; disk spines few and long; arm spines very long .... *O. longispina*

7. **Ophiopholis aculeata** forma **kennerlyi** (Lyman)

Ophiopholis kennerlyi Lyman, 1860, Proc. Bost. Soc. Nat. Hist., vol. 7, p. 200.

Ophiopholis aculeata var. *kennerlyi* H. L. Clark, 1911, Bull. U. S. N. M. 75, p. 132.

Disk with granules covering radial shields. Primary plates sometimes visible. Interbrachial spaces with spinules. Five arm spines. One small tentacle scale.

Disk diameters ranging from 3 mm. to 9 mm.

Color in life. There is considerable variation. Aboral side of disk: White center with ox-blood red markings; chocolate disk; or brownish olive with chestnut brown marblings; or Vandyke red; or mottlings intermixed of dark red and olive. Arms, dorsally, brownish olive with lateral bands and splotches of chocolate; or light brownish with irregular cross-bands of Pompeian red, from one to three plates wide; or mottled dark red and olive. Oral side of disk and arms, near mouth, white; interbrachial spaces chocolate, or olive, or dark dull yellow green. Arms, ventrally, pinkish, with cross-bands of reddish brown, which are irregular; or white crossed by vinaceous

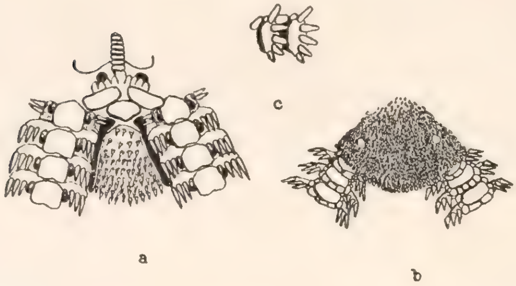

Fig. 6. Ophiopholis aculeata for. kennerlyi, X4.6.—a, from below; b, from above; c, side view of two arm joints near disk.

bands three plates wide; or white with magenta purple central line.

Although the form *kennerlyi* is found with perfect regularity as the representative of *Ophiopholis aculeata* in Monterey Bay, it is preferable to keep it as a variety, and not raise it to the rank of a geographical subspecies, as is well pointed out by Clark (1911, p. 115). On the other hand, because of the stability of this variety in the Bay, I have retained the varietal name.

SPECIMENS OF OPHIOPHOLIS ACULEATA forma KENNERLYI EXAMINED.—Thirty-two.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4441	Point Pinos Light House, N. 87° W., 1.7 miles	35–28	Blue mud, sand, shells	1
4496	Santa Cruz Light House, N. 80° W., 2.1 miles	10	fine gray sand, rock	1
4531	Point Pinos Light House, N. 64° E., 2.1 miles	26–28	fine gray Sand, pebbles, rock	1
4532	Point Pinos Light House, N. 76° E., 2.3 miles	30	gray sand, rock	5
4550	Point Pinos Light House, S. 6° E., 4.6 miles	50–57	green mud, rock	1
	Monterey			13
	Off Del Monte, June 1906	10–15	blue mud	7
	Pacific Grove, 1921	Littoral	rocky	3

Bathymetrical range, Intertidal to 57 fathoms.

8. **Ophiopholis bakeri** McClendon

Ophiopholis bakeri McClendon, 1909, Univ. Calif. Publ. Zool., 6, p. 41, pl. 5, f. 26, 27.

Disk diameters range between 2 mm. and 10 mm; radial shields as well as disk covered by thorny spinules more or less. Oral shields very wide. Four to six moderately long minutely thorny arm spines.

Color (dried from alcohol), pink or white.

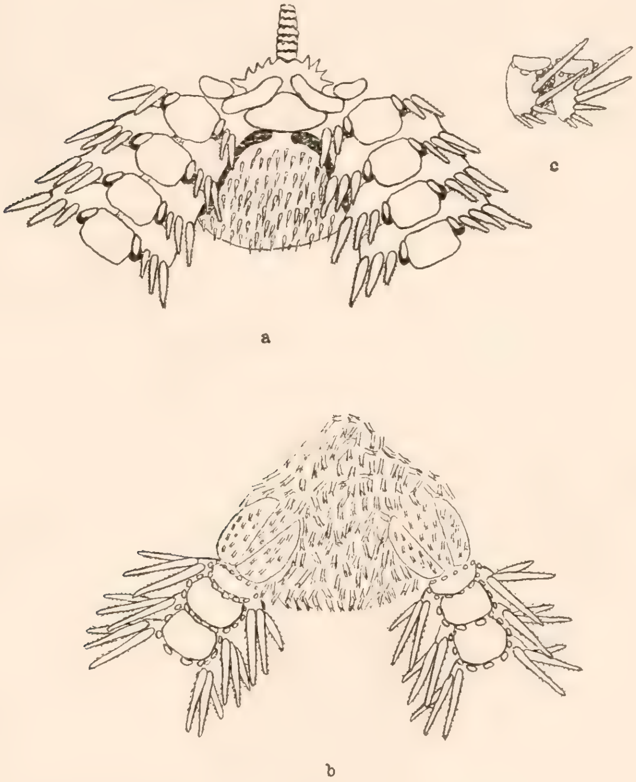

Fig. 7. Ophiopholis bakeri, X7.2.—a, from below; b, from above; c, side view of two arm joints near disk.

SPECIMENS OF OPHIOPHOLIS BAKERI EXAMINED.—Fifty-six.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4441	Point Pinos Light House, N. 87° W., 1.7 miles..........	35–28	blue mud, sand, shells.........	4
4462	Point Pinos Light House, S. 5° W., 8.5 miles..............	265–161	green mud......	3
4463	Point Pinos Light House, S. 17° W., 8 miles...............	111–48	rocky...........	2
4531	Point Pinos Light House, N. 64° E., 2.1 miles...........	26–28	fine gray sand, pebbles, rock...	3
4532	Point Pinos Light House, N. 76° E., 2.3 miles...........	30	gray sand, rock...	3
4535	Point Pinos Light House, N. 86° E., 3.7 miles...........	71–54	hard gray sand...	10
4543	Point Pinos Light House, S. 25° E., 5.4 miles..............	93–53	hard sand, rock...	12
4551	Point Pinos Light House, S. 9° E., 4.5 miles..............	56–46	coarse sand, shells, rock..........	8
4552	Point Pinos Light House, S. 73° E., 4 miles................	73–66	green mud, rock..	2
4553	Point Pinos Light House, S. 67° E., 3.7 miles..............	74–65	rock............	2
4554	Point Pinos Light House, S. 76° E., 3 miles................	60–80	green mud, rock..	4
4555	Point Pinos Light House, S. 63° E., 3.4 miles..............	66–69	green mud, rock..	2
4558	Point Pinos Light House, S. 79° W., 2 miles...............	40–28	rock............	1

Bathymetrical range, 26 to 265 fathoms.

9. **Ophiopholis longispina** H. L. Clark

Ophiopholis longispina H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 119, f. 45.

Disk, 12 mm. in diameter, covered in large part by bare radial shields. Between these are long, slender spines. Six to eight slender, long, bluntly pointed arm spines.

Color in life. Aboral surface of disk olive-gray, plumbeous, pink adjacent to base of arms; spinelets on disk light brownish;

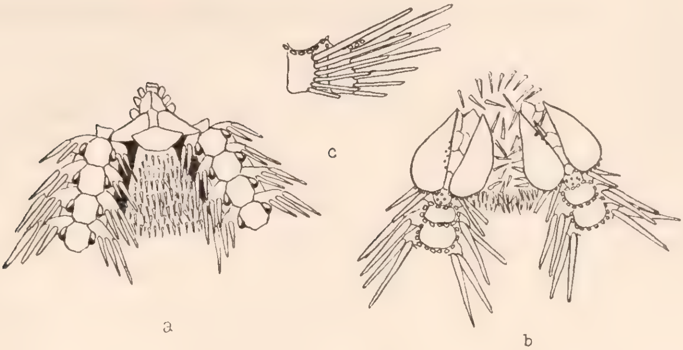

Fig. 8. Ophiopholis longispina, X3.6.—a, from below; b, from above; c, side view of two arm joints near disk.

arms rose-pink; spines nearly white. Oral surface: Interbrachial spaces brownish at edge, grayish medially; arms cream white, pinkish at tip.

SPECIMENS OF OPHIOPHOLIS LONGISPINA EXAMINED.—

One from station 4514, Point Pinos Light House, S. 39° E., 10.7 miles, 406 to 394 fathoms, green mud, rocks.

Genus **Amphilimna** Verrill

Amphilimna Verrill, 1899, Bull. Univ. Iowa, new ser., 1, No. 6, p. 30.

Oral papillæ four or five in a series; dental papillæ two to four. Arm-spines six to 10, of moderate length. Tentacle-scales usually two. Disk swollen dorsally, with a notch over the base of each arm, and covered with spinules. Radial shields parallel, largely in contact.

10. **Amphilimna pentacantha** H. L. Clark

Amphilimna pentacantha H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 172, f. 77.

Disk diameters ranging from 5 mm. to 10 mm. Many disk scales carry minute sharp spines. Radial shields long, narrow. Five arm spines at base of arm, three toward middle of arm. Tentacle scales two.

Color (dried from alcohol). Disk gray, arms yellowish white.

SPECIMENS OF AMPHILIMNA PENTACANTHA EXAMINED.—
Twenty-three.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4445	Point Pinos Light House, S. 13° E., 6 miles	66–60	green mud	1
4448	Point Pinos Light House, S. 41° W., 4.8 miles	45–34	green mud	1
4452	Point Pinos Light House, S. 21° W., 3.4 miles	49–50	green mud, fine sand	2
4457	Point Pinos Light House, S. 21° W., 6.1 miles	46–40	dark green mud	2
4464	Point Pinos Light House, S. 20° W., 7.8 miles	51–36	soft dark gray mud	1
4475	Point Pinos Light House, S. 15° W., 9.7 miles	85–58	soft green mud	2
4480	Santa Cruz Light House, N. 31° W., 6.1 miles	76–53	dark green mud, sand	2
4482	Santa Cruz Light House, N. 39° W., 8.7 miles	43–44	soft green mud	3
4523	Point Pinos Light House, S. 17° W., 9.5 miles	108–75	soft dark mud	1
4548	Point Pinos Light House, S. 26° W., 3 miles	46–54	coarse sand, shells, rock	1
4549	Point Pinos Light House, S. 9° W., 2.6 miles	56–57	coarse sand, shells, rock	4
4556	Point Pinos Light House, S. 7° E., 3.7 miles	56–59	rock	3

Bathymetrical range, 34 to 108 fathoms.

Genus **Amphiura** Forbes

Amphiura Forbes, 1843, Trans. Lin. Soc., 19, p. 149. Type designated by Verrill, 1899, Bull. Univ. Iowa, new ser., 1, No. 6, p. 24.

One apical or subapical oral papilla; one (rarely two) small, distal papilla (oral tentacle scale); middle of jaw-edge without papillæ; mouth slits gaping. Four to seven or more (rarely three) arm spines. Radial shields divergent.

KEY TO THE SPECIES OF AMPHIURA

Arm spines at base of arm, five; a portion of disk, on aboral side, often naked
....*A. arcystata*
Arm spines at base of arm three or four; disk always scaly on aboral side
....*A. seminuda*

11. **Amphiura arcystata** H. L. Clark

Amphiura acrystata (err. typ.) H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 145, f. 58.

Disk diameters ranging from 4 mm. to 7 mm; disk usually naked at center and in the interradii, with scaling around the radial shields; or sometimes scaled completely on aboral side. Interbrachial spaces usually naked. Two oral papillæ, but first tentacle scale is easily mistaken for a third papilla. Five arm spines near disk. Color (dried from alcohol). Disk and arms light orange; skin brown; scales grayish white.

SPECIMENS OF AMPHIURA ARCYSTATA EXAMINED.—Four.

Station 4510, Point Pinos Light House, S. 15° W., 9.3 miles, 156-91 fathoms, gray mud, 2 specimens.

Station 4549, Point Pinos Light House, S. 9° W., 2.6 miles, 56-57 fathoms, coarse sand, shells, rock, 2 specimens.

Bathymetrical range, 56 to 156 fathoms.

12. **Amphiura seminuda** Lütken & Mortensen

Amphiura seminuda Lütken & Mortensen, 1899, Mem. M. C. Z., 23, p. 148, pl. 11, f. 1-3.

Disk diameters ranging from 5 mm. to 9 mm; disk scaled. One infradental papilla, and one side papilla, on each side. Interbrachial spaces naked, with a band of scales along the margin. In the Monterey Bay specimens, there are often four spines at the base of the arm. On the same individual, some arms have three, and some have four spines at the base of the arm, near the disk. All have three spines distally. The radial shields are divergent the whole length.

Color in life. Disk, lead color; arms yellowish white.

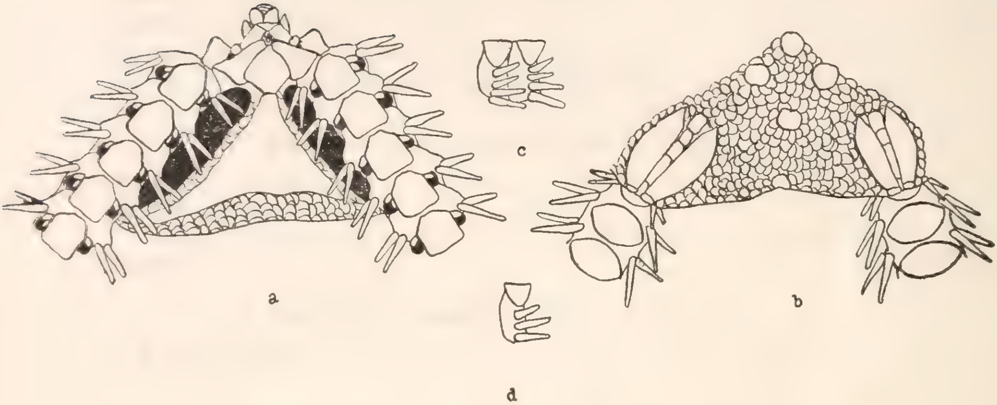

Fig. 9. Amphiura seminuda, X9.4.—a, from below; b, from above; c, side view of two arm joints near disk; d, side view of an arm joint about middle of arm.

SPECIMENS OF AMPHIURA SEMINUDA EXAMINED.—Fifteen.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4462	Point Pinos Light House, S. 5° W., 8.5 miles	265–161	green mud	2
4463	Point Pinos Light House, S. 17° W., 8 miles	111–48	rocky	2
4509	Point Pinos Light House, S. 13° W., 8.6 miles	286–152	soft gray mud	2
4515	Point Pinos Light House, S. 18° E., 8.1 miles	495–198	green mud, coarse sand, shells	1
4517	Point Pinos Light House, S. 52° E., 9.1 miles	766–750	green mud, sand	1
4528	Point Pinos Light House, S. 58° E., 12.7 miles	766–800	soft gray mud	1
4537	Point Pinos Light House, S. 74° E., 7.4 miles	1062–861	hard sand, mud	4
4546	Point Pinos Light House, S. 46° E., 8.4 miles	849	fine black sand, rock	2

Bathymetrical range, 48 to 1062 fathoms.

Genus **Amphiodia** Verrill

Amphiodia Verrill, 1899, Bull. Univ. Iowa, new ser., 1, No. 6, p. 25.

Three (rarely four) small subequal oral papillæ, none of them operculiform; they form a regular series, attached mostly to the side jaw-plate. Three (rarely four) arm spines. Radial shields often more or less joined.

KEY TO THE SPECIES OF AMPHIODIA

Arm spines flat, blunt .... *A. occidentalis*
Arm spines sharp, terete.
  Marginal row of distinct scales to disk .... *A. periercta*
  No marginal scales. Some of the disk scales near the arm have fine prickles on their edges .... *A. urtica*

13. **Amphiodia occidentalis** (Lyman)

Amphiura occidentalis Lyman, 1860, Proc. Boston Soc. Nat. Hist., 7, p. 194; 1865, Illus. Cat. M. C. Z., No. 1, p. 130, f. 12, 13.

Amphiodia occidentalis Verrill, 1899, Trans. Conn., Acad., 10, p. 313.

Disk diameters ranging from 3 mm. to 9 mm.; disk covered with scales which do not bear prickles; radial shields may be completely separated, or joined for nearly their whole length. Arm spines flat, blunt.

Color in life. There is considerable variation. Aboral side of disk: Light gray; or smoke gray; or grayish white with reddish markings on it and radial shields. Dorsal side of arms: Whitish, with irregular iron gray markings; or yellowish with light gray markings; or whitish with irregular peach red markings very widely distributed, and spines flesh pink. Oral side: Interbrachial spaces, light gray, or grayish with reddish markings; arms, whitish with light gray markings; or light cream yellow with irregular blackish gray markings; or peach red, and spines flesh pink.

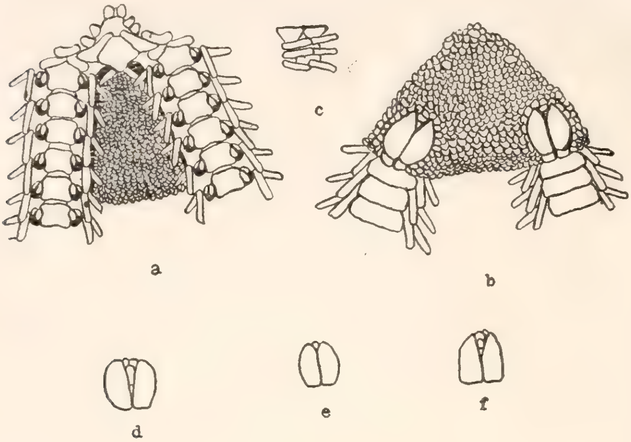

Fig. 10. Amphiodia occidentalis, X10.—a, from below; b, from above; c, side view of two arm joints near disk; d, e, f, variations in radial shields.

SPECIMENS OF AMPHIODIA OCCIDENTALIS EXAMINED.—

Seventy-one, from Pacific Grove, intertidal; and from off Del Monte, 10 to 15 fathoms, June 1906, 4 specimens.

Bathymetrical range, low tide to 15 fathoms.

14. **Amphiodia periercta** H. L. Clark

Amphiodia periercta H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 156, f. 68.

Disk diameters ranging from 3 mm. to 8 mm.; disk margin formed by a row of quite distinct scales, which may stand more or less erect and be bluntly pointed. Upper arm plates very wide; arm spines sharp, terete.

Color (dried from alcohol), pale fawn color, or yellowish brown.

SPECIMENS OF AMPHIODIA PERIERCTA EXAMINED.—Thirteen.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4454	Point Pinos Light House, S. 13° E., 8.3 miles.	71–65	green mud, sand, gravel.	8
4543	Point Pinos Light House, S. 25° E., 5.4 miles.	95–53	hard sand, rock. .	1
4549	Point Pinos Light House, S. 9° W., 2.6 miles.	56–57	coarse sand, shells, rock.	1
4550	Point Pinos Light House, S. 6° E., 4.6 miles.	50–57	green mud, rock	2
4551	Point Pinos Light House, S. 9° E., 4.5 miles.	56–46	coarse sand, shells, rock.	1

Bathymetrical range, 46 to 71 fathoms.

Since some doubts have been expressed as to the possible distinctness of *Amphiodia peloria* Busch from *Amphiodia periercta* H. L. Clark, I made a careful study of both species at the Museum of Comparative Zoölogy, having at my disposal the type of *Amphiodia peloria* Busch and the cotype of *Amphiodia periercta* H. L. Clark. In my opinion the differences are marked and one could not mistake one species for the other. In *A. peloria* the arms are over 15 times the diameter of the disk, the arm spines are flat, the oral shields are circular or nearly so, the adoral plates scarcely meet, the two tentacle scales are widely separated from each other on the proximal half of the arm. In *A. periercta* the arms are about 10 times the diameter of the disk, the arm spines are terete, the oral shields are angular, the adoral plates meet fully, the two tentacle scales lie close to each other on the proximal as well as on the distal half of the arm. The two species are thus quite distinct.

15. **Amphiodia urtica** (Lyman)

Amphiura urtica Lyman, 1860, Proc. Boston Soc. Nat. Hist., 7, p. 195.

Amphiodia urtica Verrill, 1899, Trans. Conn. Acad., 10, p. 313; H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 154, f. 64.

Disk diameters ranging from 3 mm. to 6 mm.; some of the disk-scales, mostly near arms, bearing fine prickles on their edges; these can best be seen with the low power of a compound microscope. Upper arm plates with outer side less curved than inner side. The radial shields may be completely separated by a series of scales, or may be joined for most of their length. Arm spines terete, sharp.

Color (dried from alcohol). Disk dark or light gray; arms white or light straw color.

SPECIMENS OF AMPHIODIA URTICA EXAMINED.—Seventy-seven.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4446	Point Pinos Light House, S. 2° W., 5 miles	59–52	green mud	1
4452	Point Pinos Light House, S. 21° W., 3.4 miles	49–50	green mud, fine sand	15
4453	Point Pinos Light House, S. 17° W., 2.3 miles	49–51	dark green mud	2
4457	Point Pinos Light House, S. 21° W., 6.1 miles	46–40	dark green mud	3
4464	Point Pinos Light House, S. 20° W., 7.8 miles	51–36	soft dark gray mud	21
4523	Point Pinos Light House, S. 17° W., 9.5 miles	108–75	soft dark mud	2
4549	Point Pinos Light House, S. 9° W., 2.6 miles	56–57	coarse sand, shells, rock	28
4550	Point Pinos Light House, S. 6° E., 4.6 miles	50–57	green mud, rock	5

Bathymetrical range, 36 to 108 fathoms.

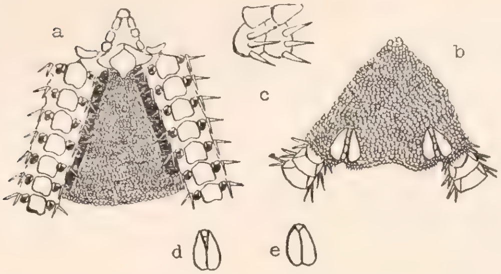

Fig. 11. Amphiodia urtica, X10.—a, from below; b, from above; c, side view of two arm joints near disk; d, e, variations in radial shields. In b, the specimen has been distorted through drying. The radial shields naturally lie on either side of the arm.

Genus **Amphipholis** Ljungman

Amphipholis Ljungman, 1866, Öfv. Kongl. Vet.-akad. Förh., 23, p. 165.

Two small lateral oral papillæ and one broad operculiform, distal one, forming a continuous series along the entire jaw, and capable of nearly or quite closing the mouth-slits. Radial shields in close contact.

16. **Amphipholis pugetana** (Lyman)

Amphiura pugetana Lyman, 1860, Proc. Boston Soc. Nat. Hist., 7, p. 193.

Amphipholis pugetana Ljungman, 1867, Öfv. Kongl. Vet.-akad Förh., 23, p. 312; McClendon, 1909, Univ. Calif. Publ. Zool., 6, p. 43, pl. 2, f. 12, 13.

Disk diameters ranging from 1 mm. to 4 mm. Radial shields meeting along their whole length. Distal oral papilla long, operculiform. Three terete, sharp, arm spines.

Color in life. There is some variation. Aboral side of disk, reddish brown, or pink, or dark gray; arms, dorsally, white, with mottlings of light gray; or white with blackish irregular marblings. Oral side: Interbrachial spaces, light pink, or light gray; arms, white with very light gray mottlings.

November 21, 1924

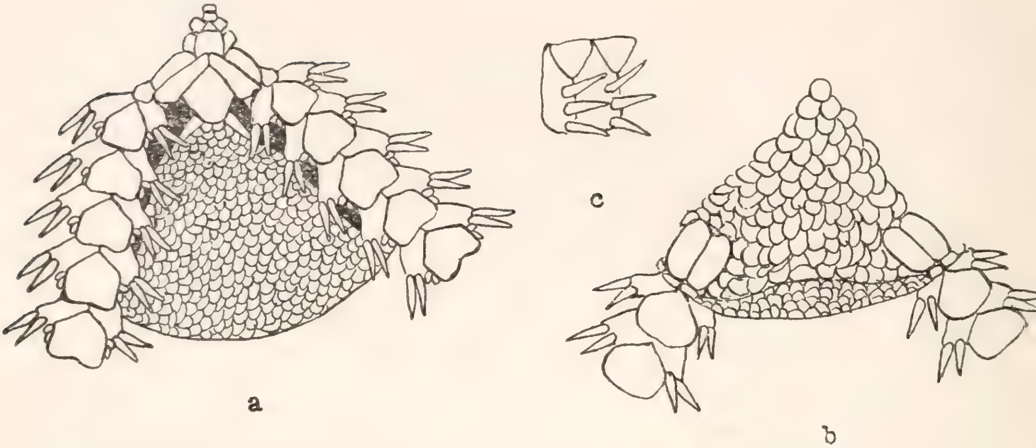

Fig. 12. Amphipholis pugetana, X21.5.—a, from below; b, from above; c, side view of two arm joints near disk.

SPECIMENS OF AMPHIPHOLIS PUGETANA EXAMINED.—Forty-seven.

Station 4496, Santa Cruz Light House, N. 80° W., 2.1 miles, 10 fathoms, fine gray sand, rock, 1 specimen.

Station 4520, Point Pinos Light House, S. 28° W., 11.2 miles, 32-44 fathoms, green mud, 1 specimen.

Off Del Monte, June, 1906, 10-19 fathoms, blue mud, 2 specimens.

Monterey and Pacific Grove, intertidal, 43 specimens.

Bathymetrical range, low tide to 44 fathoms.

Family VI. OPHIOLEPIDIDÆ

Genus **Ophiura** Lamarck

Ophiura Lamarck, 1816, Anim. sans Vert., 2, p. 540.

Disk covered with scales which are often swollen. In the disk, over the base of the arm, is a notch usually edged with papillæ. Two genital openings starting from the sides of the mouth shield. Arm spines short and smooth, rarely exceeding the length of a joint. Tentacle scales numerous, the innermost pair of tentacle pores shaped like slits surrounded by numerous tentacle scales and opening diagonally into the mouth slit. Teeth. No dental papillæ. Oral papillæ long within, but small and short near outer end of the mouth slit and partly hidden by the scales of the oral tentacles.

Key to the Species of Ophiura

Arm comb made up of very slender papillæ, their length at least five times their thickness. . . . .*O. leptoctenia*

Arm comb made up of short, broad, truncate papillæ, which are closely crowded side by side, so that there is no resemblance to a comb. . . . . . .*O. lütkenii*

17. **Ophiura leptoctenia** H. L. Clark

Ophiura leptoctenia H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 51, f. 12.

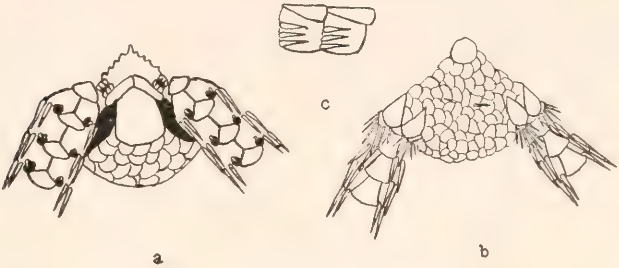

Fig. 13. Ophiura leptoctenia, X9.2.—a, from below; b, from above; c, side view of two arm joints near disk.

Disk diameter of specimen, 4 mm.; disk covered with imbricated scales. Under arm plates small, widely separated; arm comb of papillæ more or less needle-like; three sharp arm spines nearly as long as a joint. Tentacle scale on arm pores spine-like, not rounded. Color (dried from alcohol), white.

SPECIMEN OF OPHIURA LEPTOCTENIA EXAMINED.—One from Station 4536, Point Pinos Light House, S. 65° E., 9.6 miles, 1006-1041 fathoms, hard sand, mud.

18. **Ophiura lütkenii** (Lyman)

Ophioglypha lütkenii Lyman, 1860, Proc. Boston Soc. Nat. Hist., 7, p. 197.

Ophiura lütkenii Meissner, 1901, Brown's Thierreichs, 2, abt. 3, p. 925; McClendon, 1909, Univ. Calif. Publ. Zool., 6, pl. 6, f. 32, 33.

(See figure 1, page 265)

Disk diameters ranging from 4 mm. to 22 mm. Length of arm about 5.5 times diameter of disk. Radial shields small, ovoid, pointed within. A notch above the base of the arm. Three tapering arm spines, the dorsal one about as long as the arm joint. Arm comb of short, broad, truncate papillæ, which are closely crowded side by side, so that there is no resemblance to a comb.

Color in life. "Salmon red with cinnamon". Dried from alcohol: Gray on disk and arms on aboral side, with white spots often present on disk; aboral side grayish white. (The color and markings in life are extremely variable.—W.K.F.)

SPECIMENS OF OPHIURA LÜTKENII EXAMINED.—
Seven hundred ninety-seven.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4439	Point Pinos Light House, S. 38° W., 1.5 miles	42–40	gray sand, shells	2
4441	Point Pinos Light House, N. 87° W., 1.7 miles	35–28	blue mud, sand, shells	1
4444	Point Pinos Light House, S. 67° W., 2.9 miles	40	fine gray sand	1
4446	Point Pinos Light House, S. 2° W., 5 miles	59–52	green mud	144
4447	Point Pinos Light House, S. 21° W., 4.5 miles	52–42	green mud	7
4452	Point Pinos Light House, S. 21° W., 3.4 miles	49–50	green mud, fine sand	13
4453	Point Pinos Light House, S. 17° W., 2.3 miles	49–51	dark green mud	19
4454	Point Pinos Light House, S. 13° E., 8.3 miles	71–65	green mud, sand, gravel	1
4455	Point Pinos Light House, S. 6° E., 7.6 miles	62–56	green mud	2
4457	Point Pinos Light House, S. 21° W., 6.1 miles	46–40	dark green mud	55
4460	Point Pinos Light House, S. 12° E., 10.8 miles	55–671	green mud, gravel	7
4461	Point Pinos Light House, S. 3° E., 9.3 miles	285–357	green mud	2

SPECIMENS OF OPHIURA LÜTKENII EXAMINED.—Continued.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4464	Point Pinos Light House, S. 20° W., 7.8 miles..............	51–36	soft dark gray mud	27
4465	Point Pinos Light House, S. 29° W., 7.6 miles..............	31–21	hard gray sand...	2
4467	Santa Cruz Light House, N. 28° W., 8.8 miles..............	54–51	soft dark green mud..........	10
4468	Santa Cruz Light House, N. 32° W., 10.3 miles.............	51–309	fine sand........	8
4473	Point Pinos Light House, S. 15° E., 2.8 miles..............	54–65	gray sand, mud...	16
4474	Point Pinos Light House, S. 34° W., 1.2 miles	43–34	hard sand, mud..	161
4475	Point Pinos Light House, S. 15° W., 9.7 miles..............	85–58	soft green mud...	1
4477	Point Pinos Light House, S. 31° W., 9.2 miles..............	19–11	soft green mud...	5
4478	Santa Cruz Light House, N. 13° W., 3.8 miles..............	30	hard sand.......	1
4479	Santa Cruz Light House, N. 25° W., 5.1 miles..............	33–45	hard sand.......	4
4480	Santa Cruz Light House, N. 31° W., 6.1 miles..............	76–53	dark green mud, sand..........	7
4482	Santa Cruz Light House, N. 39° W., 8.7 miles..............	43–44	soft green mud...	40
4489	Santa Cruz Light House, N. 42° W., 3.7 miles..............	20–18	dark gray sand...	4
4492	Santa Cruz Light House, N. 54° W., 7 miles...............	26–27	soft green mud, rock..........	151
4521	Point Pinos Light House, S. 25° W., 10.8 miles.............	119–140	dark green mud..	2
4535	Point Pinos Light House, N. 86° E., 3.7 miles...........	71–54	hard gray sand...	1
4548	Point Pinos Light House, N. 26° W., 3 miles............	46–54	coarse sand, shells, rock..........	3
4550	Point Pinos Light House, S. 6° E., 4.6 miles..............	50–57	green mud, rock..	26
4551	Point Pinos Light House, S. 9° E., 4.5 miles..............	56–46	coarse sand, shells, rock..........	2

SPECIMENS OF OPHIURA LÜTKENII EXAMINED.—Continued.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
	Near Bell Buoy, 11th haul.....	241	rocky...........	6
	Off Del Monte..............	28	shell............	1
	Monterey Bay..............	....	....	65

Bathymetrical range, 11 to 357 fathoms.

Ophiura lütkenii is the most abundant deep-sea species in Monterey Bay.

Genus **Ophiocten** Lütken

Ophiocten Lütken, 1855, Vid. med. f. 1854, p. 102.

Disk thick and circular. No notch in the disk at the base of the arms. Side arm plates come together below, but not above. The broad oral tentacle is enclosed between the first ventral arm plate and the outer edge of the side arm plate. Teeth; oral papillæ; no dental papillæ. Two genital openings beginning at the side of the oral shield.

Key to the Species of Ophiocten

No arm comb. Arm spines six to eight...............	*O. culveri* new species
Arm comb. Arm spines three.................................	*O. hastatum*

19. **Ophiocten culveri** May, new species

Disk 16.5 mm. in diameter. Arms broken, about 62 mm. long. Disk very flat, covered by a coat of scales among which the primary plates and the radial shields are prominent. Scales irregular in size, some much larger than others. Radial shields with inner sides flat, outer sides rounded, somewhat oval or slightly triangular, with rounded corners; the two radial shields are separated completely by one, two, or three rows of scales. Upper arm plates tetragonal, lateral margins somewhat divergent, wider than long at base of arm, but soon becoming squarish or very slightly longer than wide.

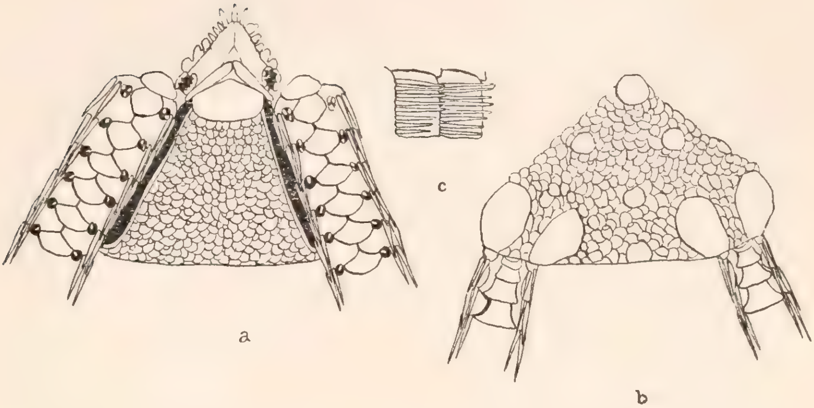

Fig. 14. Ophiocten culveri, X4.—a, from below; b, from above; c, side view of two arm joints near disk.

Interbrachial spaces below covered by about 60 irregularly sized scales, as on disk. Oral shields fairly large, pentagonal, wider than long. Adoral plates narrow, going to sides of oral shield; they meet proximately, leaving a triangular space between the oral shield and their point of meeting. Oral plates rather large. Oral papillæ about six on a side, and an apical papilla; apical papilla, and one papilla on either side long, pointed; other papillæ irregular, sometimes dentate. Genital slits long; genital scales not present, but slits bordered by one or two very long, narrow plates. No marginal papillæ to genital slits. No trace of an arm comb. Under arm plates wider than long; first two plates in contact, but other plates separated. First two plates tetragonal, succeeding plates triangular, with outer corners rounded, becoming pentagonal toward tip of arms. Side arm plates rather large, meeting below beyond second plate, but not above; each plate carries six to eight narrow, sharp arm spines, of which the uppermost is usually the longest, and about equal to an arm joint; the other spines are successively shorter. Oral tentacle pore surrounded by six to eight scales. First three arm pores with two or three scales; succeeding tentacle pores with single pointed scale.

Color (dried from alcohol), pale brownish gray.

Color in life. Aboral side of disk, vermilion irregularly washed with plumbeous; arms light orange vermilion. Oral side: Interbrachial spaces same as disk; under arm plates yellowish white.

Type: No. E1199, U. S. Nat. Mus., collected by the U. S. Bureau of Fisheries' steamer Albatross, in 1904, in **Monterey Bay**. (Exact locality not recorded). United States National Museum, Washington, D. C.

I take pleasure in naming this species in honor of George B. Culver, Dean of Men, Stanford University, my first teacher in Zoölogy.

This species differs from *Ophiocten hastatum* in having six to eight arm spines instead of three, in the absence of an arm comb, and in more numerous oral papillæ usually.

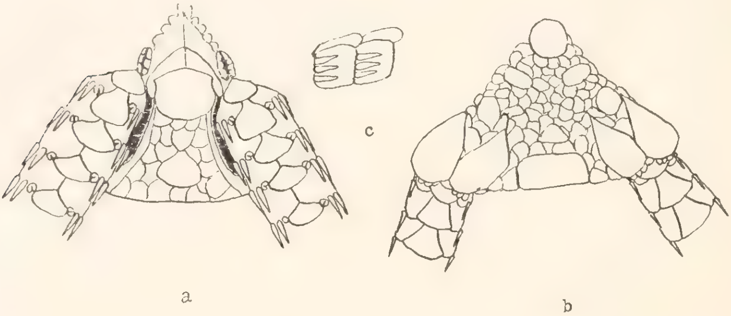

Fig. 15. Ophiocten hastatum, X8.6.—a, from below; b, from above; c, side view of two arm joints near disk.

20. **Ophiocten hastatum** Lyman

Ophiocten hastatum Lyman, 1878, Bull. Mus. Comp. Zool., 5, figs. 133, 134; Koehler, 1922, Bull. U. S. N. M. 100, vol. 5, p. 388.

Ophiocten pacificum Lütken & Mortensen, 1899, Mem. M. C. Z. 23, p. 131, pl. 3, f. 5-7.

Diameters of disk ranging from 6 mm. to 8 mm. Five to six pairs of oral papillæ in each jaw, the inner one spinous.

Arm comb continuous with genital papillæ; three arm spines, sharp, slender, tapering.

Color (dried from alcohol), gray or light brown.

SPECIMENS OF OPHIOCTEN HASTATUM EXAMINED.—Four, from Station 4537, Point Pinos Light House, S. 74° E., 7.4 miles, 1062-861 fathoms, hard sand, mud.

Through Mr. Austin H. Clark, of the United States National Museum, I learned that Dr. René Koehler, in a forthcoming work on Philippine Ophiurans (op. cit.), had synonymised *Ophiocten pacificum* Lütken & Mortensen, with *Ophiocten hastatum* Lyman. I then made a careful study of the cotypes of both species in the Museum of Comparative Zoölogy, and came to the same conclusion as Koehler, since the specimens all showed essentially the same characteristics.

Genus **Ophioplocus** Lyman

Ophioplocus Lyman, 1861, Proc. Boston Soc. Nat. Hist., 8, p. 75.

Disk closely and finely scaled above and below. Genital scales hidden. Teeth. No dental papillæ. Numerous even, close-set, oral papillæ. Adoral plates wide and nearly or quite meeting within. Three short arm spines. Upper arm plates, near tip of arm, divided on midline into halves, which at base of arm are removed to outer lower corner of joint on each side and separated by a number of supplementary pieces. Two short genital openings in each interbrachial space extending only half way to the margin of the disk, and beginning outside the oral shields.

21. **Ophioplocus esmarki** Lyman

Ophioplocus esmarki Lyman, 1874, Bull. M. C. Z., 3, 227.

Disk diameters ranging from 6 mm. to 17 mm. Upper arm plates broken up and separated by small supplementary plates. Radial shields very small and inconspicuous. My specimens have usually only two arm spines. An arm may have three spines mostly, or only a few groups of three spines, or all groups of two spines, which is the case usually. Some specimens have two spines on all the arms.

Color in life. There is some diversity; young specimens are lighter in color than older specimens. Aboral side of disk and arms, warm sepia, cinnamon brown, or buckthorn brown; or disk neutral gray, while arms are vinaceous buff. Oral side of disk, snuff brown, dresden brown, orange cinnamon, pinkish cinnamon, warm buff, neutral gray. Ventral side of arms, orange cinnamon, tawny, warm buff, pinkish cinnamon, vinaceous buff, cinnamon.

SPECIMENS OF OPHIOPLOCUS ESMARKI EXAMINED.—Twenty-nine, from Pacific Grove, and the region between Point Pinos and Carmel Bay; intertidal.

Family VII. Ophiochitonidæ

Genus **Ophionereis** Lütken

Ophionereis Lütken, 1859, Add. ad. hist., Oph., Pt. 2, p. 110.

Disk covered with fine overlapping scales, radial shields nearly hidden by scales. Teeth large, oblong; mouth angle small and short and bearing 9 to 10 small, close-set papillæ. A few (3 to 5) short, smooth, arm spines; one large tentacle scale; each upper arm plate has a supplementary piece on either side. Two genital openings beginning outside the oral shield.

22. **Ophionereis eurybrachyplax** H. L. Clark

Ophionereis eurybrachyplax H. L. Clark, 1911, Bull. 75, U. S. N. M., p. 173, f. 78.

Disk diameters ranging from 11 mm. to 23 mm. Supplementary pieces small. Upper arm plates hexagonal; arm spines, stout, blunt, four at base, three at middle of arm. Tentacle scale single, large, oval. Color (dried from alcohol). Disk, light grayish brown; arms, brown mottled with whitish, or clouded with purplish; oral surface lighter.

SPECIMENS OF OPHIONEREIS EURYBRACHYPLAX EXAMINED.—Thirty-four.

Station	Locality	Depth, fathoms	Nature of bottom	Number of specimens
4535	Point Pinos Light House, N. 86° E., 3.7 miles	71–54	hard gray sand	2
4552	Point Pinos Light House, S. 73° E., 4 miles	73–66	green mud, rock	4
4553	Point Pinos Light House, S. 67° E., 3.7 miles	74–65	rock	6
4554	Point Pinos Light House, S. 76° E., 3 miles	60–80	green mud, rock	20
4555	Point Pinos Light House, S. 63° E., 3.4 miles	66–69	green mud, rock	2

Bathymetrical range, 54 to 80 fathoms.

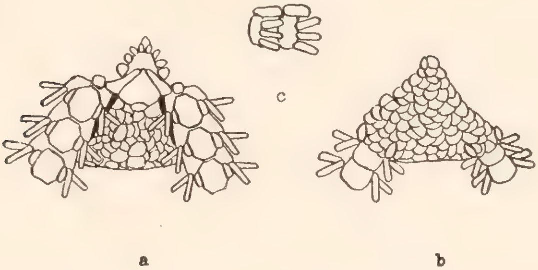

Fig. 16. Ophionereis sp. (young), X11.—a, from below; b, from above; c, side view of two arm joints near disk.

23. **Ophionereis** species, young

Disk, 3 mm. in diameter; arms about 8 mm. long; disk covered with about 280 coarse scales, some of which are larger than others; radial shields small, seed-shaped, scarcely larger than some of the disk-scales; widely separated by scales. Arms five, broad at base, narrowing to tip; upper arm plates at base of arm tetragonal, slightly wider than long, with rounded corners, broadly in contact; toward tip of arms they become triangular, with rounded corners, the apex of one plate barely, or at very tip of arms, not at all in contact with base of preceding plate. Interbrachial spaces below covered with coarse scales about the same size as those of disk. Oral shields low, triangular, with a concave base, and rounded angles, slightly wider than long. Adoral shields wider without than within. Oral papillæ four on each side, short, blunt; the outermost is the widest; teeth pointed, with rounded angles; no dental papillæ. Genital slits two in each interbrachial space, beginning at oral shield, narrow; they reach to about the middle of interbrachial spaces. First under arm plate small, squarish; succeeding plates at first octagonal, slightly longer than wide, becoming pentagonal toward tip of arms; barely or not in contact. Side arm plates large, barely meeting below, and on distal part of arm above; each plate carries three short, flat, subequal arm spines, about half as long as an arm joint. Tentacle scales single, large, oval.

Color in life. Aboral side of disk and arms mottled irregularly with light olive, white, and blackish brown. Oral side: Interbrachial spaces pinkish; arms white, with cross-bands of dark gray irregularly covering one to three plates, and spaced every one to three plates.

SPECIMEN EXAMINED.—Pacific Grove, low tide, under rock, sandy bottom; Aug. 4, 1921.

Dr. H. L. Clark determined this young form to be an Ophionereis. What species it belongs to is still problematical, since it was found too far north to be within the geographical range of *Ophionereis annulata* Le Conte, and being littoral, does not lie within the bathymetrical range of *Ophionereis eurybrachyplax* H. L. Clark.

Family VIII. OPHIOCOMIDÆ

Genus **Ophiopteris** Smith

Ophiopteris E. A. Smith, 1877, Ann. Mag. Hist., ser. 4, 19, p. 306.

Disk granulated; radial shields covered. Mouth angle small and short and with small oral papillæ; dental papillæ very numerous and arranged in a close, vertical clump; four teeth.

Arm spines smooth and solid, the upper one having one or two supplementary scale-like spines applied to its base; one tentacle scale. Two genital openings beginning outside the oral shield.

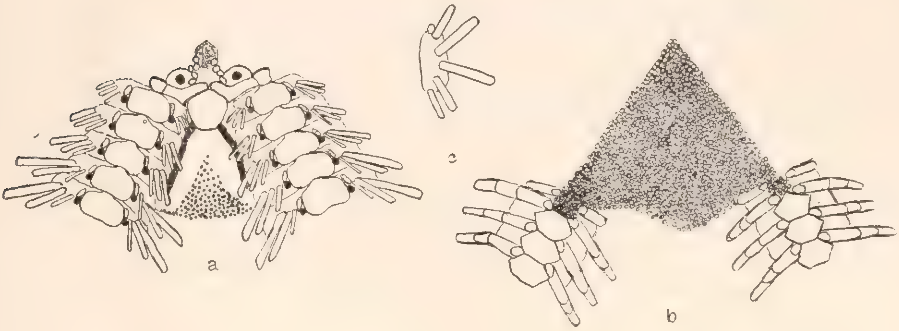

Fig. 17. Ophiopteris papillosa, X3.8.—a, from below; b, from above; c, side view of an arm joint near disk.

24. **Ophiopteris papillosa** (Lyman)

Ophiocoma papillosa Lyman, 1875, Illus. Cat., M. C. Z., No. 8, Pt. 2, p. 11.

Ophiopteris papillosa McClendon, 1909, Univ. Calif. Publ. Zool., 6, p. 49, pl. 5, f. 28, 29.

Diameters of disk ranging from 4 mm. to 30 mm.; disk completely covered with stumps. One flat tentacle scale. Dorsal arm plates hexagonal; arm spines flat and blunt.

Color in life. There is some variation. Aboral side of disk, blackish brown, bay, or dark brown; arms blackish brown, or coffee with cross bands of dark brown; or ochreous tawny, mars brown, lighter toward tips and crossed by blackish brown bands irregularly; or chestnut hazel at tips. Oral surface: Interbrachial spaces about same as disk; arms pecan brown; or hydrangea red crossed by light seal brown irregular bands, which are more conspicuous at tips of arms; or Indian red; middle of under arm plates yellowish marked with red and blue.

SPECIMENS OF OPHIOPTERIS PAPILLOSA EXAMINED.—Twenty-two.

Station 4531, Point Pinos Light House, N. 64° E., 2.1 miles, 26-28 fathoms, fine gray sand, pebbles, rock, 1 specimen.

Station 4558, Point Pinos Light House, N. 79° W., 2 miles, 40-28 fathoms, rock, 2 specimens.

Off Del Monte, 10-15 fathoms, 3 specimens.

Cypress Point, low tide, common in suitable spots.

Bathymetrical range, low tide to 40 fathoms.

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PROCEEDINGS
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XIX

PARASITIC BEES (EPEOLINÆ AND MELECTINÆ) IN THE COLLECTION OF THE CALIFORNIA ACADEMY OF SCIENCES

BY

T. D. A. COCKERELL AND GRACE SANDHOUSE*

In American Museum Novitates, No. 23 (1921) it was remarked that the Rocky Mountains apparently constituted the greatest center for Epeolines in the world, Colorado having no less than 32 species. It now appears that this supremacy may be disputed, or shared with the Pacific Coast Region, which is similarly rich in species. The collections of the California Academy of Sciences cannot be complete for the region, yet they reveal an astonishing number of endemic forms, all apparently distinguished by perfectly recognizable characters. On the other hand Pseudomelecta and Zacosmia, so far as the material shows, present no novelties and are very poor in species. It is not at first evident why the wide spread and abundant *Pseudomelecta californica* has remained true to type, while the Epeolines have undergone great specific diversification. It may be surmised, however, that the Epeolines have been long in the country while Pseudomelecta may represent a comparatively recent invasion from Asia. It is very much to be desired that the life histories of these bees should be made known, but this work must be done by resident entomologists.

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*Before leaving Boulder in June, Miss Sandhouse had finished the Melectines and had done about half the work on the Epeolines. Completing the work at the California Academy of Sciences I have to be responsible for its final form, but it is in every sense a joint production. A few species were not studied by Miss Sandhouse and I am alone responsible for their separation and description as is duly indicated.—T. D. A. C.

Epeolinæ

1. **Triepeolus concavus** (Cresson)

California: Western San Joaquin Co., July 15 to Sept. 15, 1909, one female; Utah: Kings Station, Davis Co., July 24, 1922 (Van Duzee), one male.

2. **Triepeolus lineatulus** Cockerell & Sandhouse, new species

Female (type): Length 9-11 mm. Black, including labrum, mandibles, antennæ, tegulæ, legs and spurs, only the mandibles faintly reddish in middle and the small joints of tarsi red; ornaments of thorax and abdomen very pale ochreous; eyes green. Clypeus minutely rugose with scattered shallow punctures and a smooth median line; supraclypeal area dull, contrasting with the shining upper part of clypeus; region between antennæ and orbits densely covered with white hairs; ornaments on thorax above consisting of a narrowly interrupted band on prothorax, two rather broad parallel stripes on mesothorax, reaching anterior margin, but sharply defined and not connecting with each other or spreading laterally; also large triangular patches at anterior lateral corners of mesothorax, and a broad band along hind margin of mesothorax, invading scutellum in middle; mesopleuræ black, dull and densely rugoso-punctate, with a broad, transverse, clean-cut ochreous band on its upper part, this connected anteriorly with an upward band to tegulæ; scutellum bigibbous, axillæ pointed; wings dilute brown; legs without distinct patches of hair, middle tibiæ with a band of reddened hair along anterior margin; abdomen with broad pale ochreous bands, the anterior and posterior ones on first segment narrowly interrupted; dark band on first segment elongate, transverse, broad, obtuse at ends; lower lateral corners of dark area on second segment forming acute angles (about 50°); venter entirely black, its last segment straight in profile.

Male: Length 9 to 10 mm. Similar to female in most respects. Smooth line on clypeus poorly developed but perceptible; bands on mesothorax anteriorly broader, sometimes connected with anterior lateral patches, in which case a round dark spot is left on front margin of mesothorax; mesopleura with a broad pale band all the way down its anterior margin;

anterior pale band on first abdominal segment entire or narrowly interrupted; pale abdominal bands narrower; vertex with two pale bands, interrupted in middle; apical plate black, rather broad.

Type: Female, No. 1598, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, August 20, 1919, at **Stockton, California.** *Paratypes,* two males, same data; also two females, Western San Joaquin Co., Calif., July 15-November 15, 1909.

In my key (Amer. Mus. Novitates, No. 23) this runs to *T. rectangularis* Ckll. but is easily distinguished by the markings of the abdomen and entirely black antennæ.

3. **Triepeolus vandykei** Cockerell & Sandhouse, new species

Female: Length 10.5-11 mm.; black including labrum, mandibles, antennæ, tegulæ, legs and spurs, but mandibles obscurely reddened in middle; apical part of third antennal joint dusky red; eyes pea-green; clypeus and supraclypel area sculptured alike, rugoso-punctate, somewhat glistening, with scattered shallow punctures; no smooth line on clypeus, but a little pit with smooth margins at upper margin in middle; scape curved; sordid white hair around base of antennæ; ornaments of thorax and abdomen pale ochreous; band on upper margin of prothorax rather narrow and continuous; stripes on anterior part of mesothorax parallel, reaching anterior margin, but rather weak and inconspicuous, rather dilated posteriorly, so that their inner margins converge caudad; marks of anterior lateral corners of mesothorax narrow, cuneiform, widely separated from median stripes; suture very slender; scutellum only feebly bigibbous; upper half of mesopleura with tubercles, entirely covered with hair, lower half bare, coarsely punctured, shining between the punctures; margins of tegulæ broadly obscure reddish; wings dilute brownish; middle and hind tibiæ with minute silvery pubescence on outer side, middle tibiæ with line of red hair anteriorly; basitarsi with rusty black hairs on inner side; first abdominal segment with posterior band showing a linear interruption, anterior band hardly or not interrupted, the black area transverse, round at ends, very broadly subangulate in front; bands on segments 2-4 entire, very broad; posterior lateral corners of black on second segment rectangular; fifth segment with an obscure spot on each side; venter entirely black.

Type: Female, No. 1599, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, September 1, 1912, at **Millbrae, San Mateo Co., California.** *Paratype,* one female, same data.

Runs in my table to *T. lestes* Ckll., but easily separated by color of eyes and ornamentation of pleura.

November 21, 1924

4. **Triepeolus pallidiventris** Cockerell & Sandhouse, n. sp.

Male: Length about 11 mm.; robust, black, including labrum, mandibles, antennæ, tegulæ, legs and spurs, the small joints of tarsi obscurely reddish; eyes sea-green; dense hair around antennæ pure white; clypeus glistening, minutely rugoso-punctate, with no smooth line, with secondary punctures small and evanescent; hair of thorax white, fringed with ochreous dorsally, abdominal bands pale ochreous; band on upper margin of pleura entire; mesothorax covered with pale appressed hairs, except a large trilobed area involving the posterior disc, its median lobe (anteriorly) not much larger than the others, and not at all approaching the anterior margin; scutellum strongly bigibbous; axillæ short; mesopleura with entire anterior margin broadly covered with light hair, but the posterior part is largely bare, and rugoso-punctate; tegulæ hairy in front; wings dilute brownish; second cubital cell broad (on one side very narrow, abnormal); tibiæ and basitarsi covered with appressed silvery hair; first abdominal segment dorsally covered with light hair, except a rather small median patch, which is not elongate laterally; bands on segments 2-6 very broad, even and entire; posterior lateral corners of black on second segment a little less than right angles; second and third ventral segments broadly covered with silvery hair.

Type: Male, No. 1600, Mus. Calif. Acad. Sci., Collected by E. P. Van Duzee, July 7, 1922, at **Vivian Park, Utah.**

Runs in my table to *T. trilobatus* Ckll., but differs in the ornamentation of thorax and other characters. The pattern of the pubescence is not very different from that of the much larger *T. concavus* (Cress).

5. **Triepeolus pectoralis** (Robertson)

Utah. Saltair, July 12, 1922, 1 ♀ (Van Duzee); American Fork Cañon, July 25, 1922, 1 ♂ (Van Duzee). The female has the scape and base of flagellum bright ferruginous, and stripes on mesothorax not reaching anterior margin. The male has the scape black, base of flagellum obscure red, and stripes on the mesothorax practically going to anterior margin. Both have dusky red tegulæ, and lower part of pleura polished, with strong well separated punctures. The Colorado and Utah *T. pectoralis* are variable, but, at present, I cannot separate them from Robertson's Illinois species.

6. **Triepeolus schwarzi subcalens** Cockerell & Sandhouse, new subspecies

Male (type): Smaller, length 7-8 mm.; labrum black with lower margin red, varying to all red; eyes pea-green; flagellum ferruginous on under side, and more or less above apically; longitudinal bands on mesothorax broad, reaching anterior margin, the spaces between these bands anteriorly, and also laterad of them, thinly hairy; dense hair covering pleura and thoracic venter pure white; stigma clear ferruginous; angles of black at sides of second abdominal segment sharp; light hair on second ventral segment having a broadly triangular outline. The legs are bright clear red with black spurs; the apical plate is narrow and red.

Female: Length 7.8 mm.; flattened area at the end of abdomen rather small, but of the typical Triepeolus type; face covered with pure white hair, dense at sides; labrum and mandibles red; clypeus minutely granular, with lower margin red, no smooth line; flagellum dusky reddish beneath, the sutures paler; stripes on mesothorax ochreous, better defined, with no evident pale hair between or laterad of them; pleura covered with hair; first three ventral segments with much white hair; last ventral segment red, black at base, the end conspicuously turned downward.

Type: Male, No. 1601, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, July 6, 1918, at **Redding, California**. *Paratypes,* two males, one female, same data.

Perhaps a distinct species, but so close to *T. schwarzi* Ckll. (described from Colorado), that it may for the present be regarded as a subspecies. The female of true *T. schwarzi* is not known. The female *subcalens* is so like *T. ancoratus* Ckll. that it can only be certainly distinguished by the conspicuously longer antennæ. Male *subcalens* resembles *T. balteatus* Ckll., but differs in having the disc of propodeum clothed with pale hairs (bare in *balteatus*), apical plate of abdomen narrower and lighter red, flagellum reddish beneath, mesothorax and scutellum with more widely separated punctures.

7. **Triepeolus inyoensis** Cockerell & Sandhouse, new species

Male: Length 11.3 mm.; black including antennæ, but flagellum obscurely reddened beneath; labrum entirely red, mandibles red with dark apices; tubercles black; tegulæ dull pale red; legs red, the anterior femora with basal two-thirds black in front, middle femora with only an obscure blackish stain above, hind femora suffusely stained with blackish; spurs black. Face densely covered with pure white hair; eyes pale reddish; front with long hair; vertex hairy; ornaments of head and thorax pale ochreous; upper border of prothorax densely covered with hair; mesothorax covered with coarse pale ochreous hair, with poorly defined trilobed black area on posterior disc, this being invaded by the longitudinal bands, which can be seen because a little denser and brighter than the surrounding hair; scutellum bilobed, with a wide central interval, which is hairy; axillæ short; mesopleura densely covered with pale ochreous hair; wings faintly tinged with brown; stigma red; hair on inner side of hind basitarsi pale orange; abdomen robust and subcylindrical; first segment above densely covered with ochreous hair, except a narrow transverse band, rounded at ends, much narrower than the ochreous band behind it; second segment with the lateral angles of the black produced, very acute, the oblique anterior extensions of pubescence very long, also a little pale hair basally in middle; apical band on segments 2-5 ochreous, very broad and even, but that on sixth segment white, contrasting; apical plate red, narrow; first ventral segment with a triangular patch of white hair; second and third segments covered with white hair in middle and apically at sides; sixth ventral segment with a transverse red band.

Type: Male, No. 1602, Mus. Calif. Acad. Sci., collected by Fordyce Grinnell Jr., August 15, 1914, at **Pine Creek, Inyo Co., California,** at 5,500 feet elevation.

A very distinct species, running out in my table near *T. balteatus* Ckll., from which it differs conspicously in the markings of the abdomen.

8. **Triepeolus blaisdelli** Cockerell & Sandhouse, new species

Male: Length about 9 mm., rather slender; black, with labrum, mandibles (except apically), tegulæ and legs clear red; tubercles, axillæ and spurs black; eyes sea-green; antennæ dusky red, flagellar joints pallid apically; face densely covered with silver-white hair; lower margin of clypeus red; vertex closely and finely punctured; ornaments of head and thorax dorsally very pale, ochreous tinted, but the hair which densely covers the mesopleura pure white; upper border of prothorax densely covered with hair; mesothorax rough, black, narrowly bounded by hair at sides and posteriorly; a pair of well developed stripes, reaching anterior margin; middle of mesothorax posteriorly with a groove; scutellum feebly bilobed; axillæ short and obtuse; posterior face of thorax densely covered with white hair, except a small triangle below postscutellum; wings hyaline, very faintly brownish, stigma and nervures ferruginous; second cubital cell much narrowed above; all abdominal bands (including those on first segment) broad and entire; black area on first segment transverse, bow shaped, that is convex anteriorly, straight posteriorly, and pointed at each end; lateral corners of black on second segment very long and acute; apical plate dark red, narrow; venter with broad white bands on second and third segments, that on second greatly enlarged in middle; fringes on fourth and fifth segments pale.

Type: Male, No. 1603, Mus. Calif. Acad. Sci., collected by F. E. Blaisdell, in September, at **Mokelumne Hill, California,** on flowers of Eriogonum. *Paratype,* one male, same data.

Runs in table near to *T. pœnepectoralis* Viereck, but rather recalls *T. callopus* Ckll. It will be known by the dense white hair covering thorax laterally and posteriorly, reddish antennæ, etc. Another specimen lacking the abdomen, is from Cazadero, Calif., Sept. 2, 1918 (Van Duzee).

9. **Triepeolus hæmaturus** Cockerell & Sandhouse, n. sp.

Female: Length 9-10.5 mm.; black, with lower margin of clypeus (more narrowly in middle), labrum, mandibles (except apex), tegulæ, legs and the round false pygidium all red; tubercles, axillæ and spurs black, hind spurs long; eyes grey; hair about bases of antennæ pure white; vertex densely punctured; scape black with about the apical half in front red; flagellum obscurely red beneath, bright red basally; ornaments of head and thorax pale, slightly ochreous; hair-pattern of mesothorax rather indistinct, the two stripes short and not quite reaching anterior margin; scutellum moderately bigibbous, axillæ rather short; posterior face of thorax densely covered with light hair, except a narrow band in the middle; upper part of pleura densely hairy, the lower margin of the hair very concave; lower part of pleura granular, very densely rugoso-punctate; wings brownish, stigma rufous with a dark margin; second cubital cell quite broad above; abdominal bands all broad and entire, sometimes a little notched in middle; black area on first segment a broad transverse band, rounded at ends; lower lateral corners of black on second segment produced and acute, the anterior lobes of pubescence pointed mesad; sides of the fifth segment with large patches of white tomentum; first ventral segment with an apical lunule of white hair, second covered with white hair in middle and with broad apical band laterally, third with broad apical band; fourth segment red, with white tomentum, narrowed in middle; fifth red, with a trilobed basal black mark, or the base with a black band.

Type: Female, No. 1604, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, July 12, 1922, at **Saltair, Utah.** *Paratypes,* two females, same data.

Related to *T. perelegans* Ckll. from Arizona, but readily known by the different sculpture of pleura, and largely black scape. It differs from *T. ancoratus* Ckll. by the bare space on pleura.

10. **Triepeolus rectangularis** Cockerell

Utah: Mt. Timpanogos, July 8, 1922, 1 ♂ (Van Duzee); Oregon: Wallowa Mts., Baker Co., July 6, 1922, 1 ♂ (Van Dyke). California: Huntington Lake, Fresno Co., 7000 ft., July 15, 1919, 1 ♂ (Van Duzee). The specimens have the antennæ black with at most a little obscure red on third joint.

11. **Triepeolus saturninus** Cockerell & Sandhouse, n. sp.

Male: Length about 10 mm.; black, including antennæ (except a small red spot on apical part of third joint externally), labrum (except an obscure red spot at each side), mandibles (except a bright red band in middle), tubercles and axillæ; tegulæ clear red; femora black, but knees, tibiæ and tarsi red; hind spurs black; hair on inner side of hind basitarsi, orange; eyes bright pea-green; face with pure white hair round antennæ, but on front it is long and pale brown; vertex densely punctured; ornaments of head and thorax pale ochreous, distinctly so on pleura, and quite strongly ochreous on abdomen, but dense hair on front of hind coxæ pure white; mesothorax coarsely punctured, with an ochreous marginal band, lacking only in middle anteriorly, between the longitudinal stripes; stripes broad, parallel, reaching margin, where they are connected with lateral patches by the marginal band; scutellum bigibbous; axillæ prominent; area of metathorax bare, broadly produced apically; pleura covered with hair; wings brownish, stigma black; spurs on anterior and middle legs red, on hind legs dark; transverse black area on first segment broad, squarely truncate at ends, the middle abruptly swollen (thus the whole suggesting the planet Saturn with its rings, only the rings much broader), and emitting at right angles a broad band anteriorly, and posteriorly a linear one, cutting the apical pale band; black area on second segment with much the same shape, being swollen in middle (so that its posterior margin is undulating), its outer corners obtusely rounded, and the anterior extension of pubescence prolonged mesad as long slender sharp thorn-shaped lobes; all the other bands of pubescence broad and entire; apical plate moderately broad, obscure reddish apically; venter with pale bands, and outstanding fringes pale.

Type: Male, No. 1605, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, September 1, 1912, at **Millbrae, San Mateo Co., California.**

Runs in my table to *T. schwarzi,* but easily separated by the black femora and other characters.

12. **Triepeolus brunnescens** Cockerell & Sandhouse, n. sp.

Male: Length about 9.5 mm.; black with both ends of scape, and the flagellum beneath, dusky red; labrum black with a longitudinal band of white pubescence in middle; mandibles with basal half red; tubercles and axillæ black; tegulæ clear apricot-color; legs bright red; spurs red, the hind ones darkened; eyes grey; face densely covered with pure white hair; vertex laterad of ocelli polished, with few punctures; black parts of head and thorax reddish from fine tomentum; ornaments pale ochreous; mesothoracic stripes very broad in middle, pointed behind, anteriorly not quite reaching margin, laterally, some distance from margin, connected by an isthmus of very thin hair with the triangular patches of anterior corners of mesothorax; scutellum strongly bilobed; axillæ prominent; area of the mesothorax shining and bare; pleura covered with hair, but it is thin on disc; wings brownish, stigma dark rufous; first abdominal segment with anterior bands narrowly broken; dark area on first segment a transverse band with fusiform outline, the ends pointed but not very acute; bands on second and third segments rather narrow, curved so as to leave a narrow brown marginal area; lower apical angles of dark area on second segment acute, the lobes of hair arising from the band like obliquely placed triangles, one corner confluent with the band; all the bands except on first segment entire; apical plate rather broad, black; venter dark reddish, the second and third segments with dense pure white hair-bands, the outstanding fringes yellowish.

Type: Male, No. 1606, Mus. Calif. Acad. Sci., collected by F. E. Blaisdell, September 10, 1884, at **Poway, San Diego Co., California.**

This may be compared with *T. brunneus* Ckll., from Colorado, but is easily distinguished by the pleura and pattern of abdomen.

13. **Triepeolus mensæ** Cockerell, new species

Male: Length about 9.5 mm. Similar to *T. schwarzi subcalens,* but larger, with pale purplish-grey eyes, broader face, forwardly directed points of anchor-shaped black area on mesothorax broad and obtuse instead of acute; second cubital cell as broad above as third and receiving recurrent nervure beyond its middle; anterior lobes of pubescence at sides of second abdominal segment very broad; apical plates darker, with piceous margin; axillæ longer.

The labrum is entirely red, and the flagellum bright ferruginous beneath; the clypeus is black. The femora, tibæ and tarsi are entirely clear red.

Type: Male, No. 1607, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, June 21, 1922, on the high tableland at **Warner Lake, Lake Co., Oregon.**

In my table this runs to *T. schwarzi.*

14. **Triepeolus diversipes** Cockerell, new species

Male: Length about 11 mm.; black, including antennæ (third joint red on outer face and anteriorly at apex), labrum, mandibles (except red band in middle), tubercles and axillæ; tegulæ piceous with broad suffused reddish brown margins; anterior femora and tibiæ black, the latter covered with short silvery hair; anterior tarsi red; middle and hind legs clear red, spurs black; eyes pale greyish green; face densely covered with pure white hair; vertex rugoso-punctate; ornaments of head and thorax very pale, faintly creamy; mesothoracic stripes flame-like, tapering posteriorly, broadening toward base, reaching anterior margin, and on each side sending a bridge (separated from margin) to lateral patches, all these markings dull and inconspicuous; scutellum strongly bilobed, axillæ well developed; area of metathorax bare; pleura largely covered with greyish white hair, with a round bare space below wings, and a larger, ill-defined bare patch below middle, this latter area with a little hair scattered over its surface; wings slightly dusky, stigma black; abdominal bands entire, except on first segment where the basal band is rather widely interrupted, and the apical one is deeply notched before and behind; transverse black area on first segment a very broad band, very obliquely truncate at ends; anterior lobes of pubescence on second segment shaped like the end of a finger, the lateral apical corners of the black area broadly rounded and a little less than right angles; apical plate rather narrow, black with apical part red; ventral segments 2 and 3 with clear white marginal bands, not enlarged in middle; first outstanding fringe dark in middle and pale at sides, second dark.

Type: Male, No. 1608, Mus. Calif. Acad. Sci., collected by G. R. Pilate, October 25, 1909, at **San Pedro, California.**

The specimen was presented to the Academy by E. C. Van Dyke. In my key runs to *T. dichropus* Ckll., which is allied, but differs in the details of the markings.

15. **Epeolus rufomaculatus** Cockerell & Sandhouse, n. sp.

Female (type): Length about 8 mm., black, including antennæ, but scape dull red at end; labrum black, mandibles red; tubercles and tegulæ red, axillæ black; femora black, but knees, tibiæ and tarsi chestnut red; spurs dull white; eyes pale grey; head very broad; dense white hair around base of antennæ; clypeus entirely black, very densely and minutely punctured, with no smooth line; vertex rugoso-punctate; ornaments of head and thorax very pale ochreous; mesothorax and scutellum entirely dull, minutely rugose; mesothorax bounded with light hair and with a large H-like mark anteriorly, but all these hair markings are dull and rather indistinct; scutellum weakly bigibbous; axillæ prominent; area of metathorax large, black and bare; upper half of pleura covered with light hair, lower part bare and very densely punctured; wings with the apical margin broadly pale brown; stigma black; second cubital cell receiving recurrent nervure beyond middle; hind tibiæ robust, blackened behind; hair bands of abdomen dull but clear-cut; basal band of first segment entire, but apical band widely interrupted; black area of first segment a broad parallel-sided band, the ends obliquely truncate; band on second segment moderately interrupted in middle, the mesal ends somewhat bulbous in outline; on each side anteriorly the band is contiguous with a large round spot; band on third segment narrowly interrupted in middle, and deeply constricted sublaterally; band on fourth segment also constricted at sides, but continuous in middle; fifth segment with a silvery apical lunule, and a large ferruginous patch on each side; venter with a broad white band, occupying two segments.

Male: Similar, except for the sexual characters; apical plate black and rather broad; knees, tibiæ at apex, and tarsi red; but tibiæ mainly black; second and third ventral segments with broad white bands, each having in the middle a dark elongated mark. Venation normal. Eyes green.

Type: Female, No. 1609, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, July 14, 1922, at **Logan, Utah.** *Paratypes,* three males, Millbrae, Calif., September 1, 1912, (E. C. Van Dyke); one male, Millbrae, Calif., September 1, 1912, (F. E. Blaisdell); Pacific Grove, Monterey Co., Calif., September, 1920, (F. E. Blaisdell).

Closely related to *E. asperatus* Ckll., from Los Angeles, but peculiar for the larger axillæ, red spots at end of abdomen, and abdominal markings. This refers to the female; the males from such an entirely different region and environment, may prove to belong to another species, when the female is discovered at Millbrae or Pacific Grove. At the same time there is no valid basis for treating the male as distinct.

16. **Epeolus geminatus** Cockerell & Sandhouse, new species

Female (type): Length 7.7 mm.; robust, black, including antennæ, except that apex of scape and second and third joints in front are rather dark red; labrum dark, shining and distinctly punctured; mandibles red; tubercles and tegulæ bright red, axillæ black; femora black, but knees, tibiæ and tarsi bright red, the hind tibiæ largely black; eyes purplish;

clypeus entirely black; face with white hair; vertex densely and very coarsely punctured; mesothorax anteriorly with a pair of converging and broadly contiguous claviform light ochreous hair-stripes, narrowly reaching anterior margin, and thus enclosing a black triangular area; hair of upper margin of prothorax, sides of mesothorax (broadly) and hind margin (narrowly) paler than the converging stripes; scutellum weakly bigibbous, densely rugoso-punctate, axillæ prominent; light hair of postscutellum interrupted in middle; pleura with less than upper half covered with white hair, the lower edge of the white concave; lower part of pleura very coarsely and densely punctured; wings dusky in apical field, stigma black; spurs pale ferruginous; ornaments of abdomen ochreous on first three segments, becoming almost white beyond, but the transition gradual and the last band not clear white; apical band on first segment broadly interrupted; black area on first segment transverse, obliquely truncate at sides, its median portion anteriorly with convex outline; band on second segment rather narrowly interrupted, subclavate, laterally the band rapidly broadens, but the posterior apical corners of the black are rounded and much wider than a right angle; bands on segments 3 to 5 narrowly interrupted in middle, but not sublaterally; fifth segment with the usual silvery lunule; ventral segments 2 to 4 with apical pure white bands.

Male: Similar to the female in most respects. Antennæ black, with flagellum very obscurely red beneath; pleura more or less hairy all over, but the hair thin in middle; pale hair at base of first abdominal segment interrupted in middle; apical plate very broad, black with red margin; bands on mesothorax in front more broadly united.

Type: Female, No. 1610, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, September 12, 1923, at **Mill Creek Canyon, San Bernardino Co., California.** *Paratype,* one male, Cascada, Fresno Co., Calif., 6,000 feet elevation, July 29, 1919 (Van Duzee).

A distinct little species, recognizable by the V-shaped mark on thorax anteriorly.

17. **Epeolus heterurus** Cockerell & Sandhouse, new species

Female (type): Length a little over 8 mm.; black including antennæ, labrum, mandibles (except an obscure reddish mark in middle), axillæ, tubercles, legs and spurs, but small joints of tarsi red; ornaments of head and thorax pale ochreous; eyes green, with the lower third purplish-grey; clypeus very finely and densely punctured, with no median line; pale hair about base of antennæ greyish, not white; vertex finely punctured; mesothorax at sides and posteriorly margined with dull ochreous hair, and a pair of stripes of the same on anterior middle, pointed at each end, isolated and not quite reaching the anterior margin; a slender transverse stripe along anterior margin of scutellum; scutellum not evidently bigibbous; axillæ not projecting; bare area of metathorax forming a deeper triangle than usual; mesopleura coarsely hairy behind tubercles, and with a broad transverse band of hair, narrowing posteriorly; lower part of pleura densely punctured; tegulæ black with narrow reddened margins; wings brownish, stigma black; abdominal bands entire, except apical one on first segment, which is narrowly interrupted; black area on first segment a transverse band, pointed at each end, anteriorly in middle the black extends abruptly as a rounded lobe; lower lateral angles of black on second segment acute; fifth segment with no silvery lunule, but on each side a large patch of seal brown pubescence, these patches connected posteriorly across the middle; second and third ventral segments with narrow rather inconspicuous pale hair-bands.

Male: Similar, but eyes entirely deep pea-green; mesothorax anteriorly hairy, limiting the black to a large trilobed area; apical band of first abdominal segment sometimes not interrupted; mesopleura covered with pale hair. The maxillary palpi (examined in Colestin specimen) have one long free joint, as in *Epeolus*.

Type: Female, No. 1611, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, July 6, 1918, at **Redding, California**. *Paratypes,* one female, Cayton, Shasta Co., Calif., July 9, 1918 (E. P. Van Duzee); hills back of Oakland, Calif., August 2, 1908 (Van Dyke); San Diego, Calif., May 10, 1891 (F. E. Blaisdell); Wallowa Mts., Baker Co., Oregon, July 5, 1922, one female (Van Dyke); Colestin, Jackson Co., Oregon, August 1, 1918, one male (E. P. Van Duzee).

The association of the sexes is apparently correct, but is subject to further investigation. The species is readily recognized in the female by the patch on the fifth abdominal segment, and the black legs with the small joints of tarsi red. There is some affinity with *E. pusillus* Cresson, but that has red legs.

18. **Epeolus melectimimus** Cockerell & Sandhouse, n. sp.

Male: Length about 8 mm., rather slender; black, including antennæ (flagellum thick, with truncate shining end), labrum, base of mandibles (but apex broadly chestnut red), tubercles, tegulæ, axillæ, legs (except small joints of tarsi, which are deep rufous) and spurs; eyes dark grey; face broad, rather obscure pale hair about bases of antennæ; mesothorax densely and coarsely punctured, but shining between the punctures; on anterior middle is a very inconspicuous patch of greyish hair, with three short lobes pointing backward; laterally this connects with patches of anterior corners by narrow band along front margin of mesothorax; scutellum strongly bilobed, axillæ obtuse; area of metathorax bare; pleura very densely punctured, nearly all bare, upper portion thinly hairy below and behind tubercles; also hairy just below wings; wings strongly brownish, stigma black; marginal cell normal for the genus, minutely appendiculate; second cubital receiving recurrent nervure beyond middle; ornaments of abdomen dull whitish, the bands all interrupted except the basal one on first segment, apical one on first segment widely interrupted; black area on first segment large, lenticular in outline, with pointed ends; interrupted band on second segment with each division clavate mesially, and above (basad) emitting a lobe which makes the posterior lateral angles of the black acute; third segment with each half of the band divided into two large spots; fourth with the pair of mesal spots well developed, but the lateral ones reduced to hardly perceptible marks; fifth with only the inner spots; sixth without spots; apical plate black, with conical outline; light bands on ventral segments 2 and 3 reduced to transverse marks on each side; outstanding fringes black.

Type: Male, No. 1612, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, July 7, 1919, at **Huntington Lake, Fresno Co., California,** at an elevation of 7,000 feet.

A peculiar species resembling a small *Pseudomelecta,* but readily distinguished from that genus by the marginal cell.

19. **Epeolus rubrostictus** Cockerell & Sandhouse, n. sp.

Female: Length nearly 8 mm.; black, including antennæ, labrum and axillæ, but mandibles bright red except at extreme base, tubercles clear red; legs black, with knees, tibiæ at apex and tarsi red, the hind basitarsi blackened on outer side; face broad, white hair around antennæ, but clypeus with thin grey hair, its surface very densely and minutely punctured; third antennal joint longer than fourth; eyes brownish-grey; vertex dull and rough, a shining spot immediately laterad of each lateral ocellus; upper border of prothorax hardly hairy; mesothorax coarsely rugose, with a median shining groove; stripes of mesothorax narrow, far apart, warm ochreous, reaching anterior margin, where they extend laterad, but they do not approach the patches at anterior corners; scutellum bigibbous, axillæ rather prominent; area of metathorax large and bare; pleura with upper part densely hairy, except a patch below wings, lower part with a large bare patch, which is extremely densely punctured; tegulæ bright apricot-color; wings broadly dusky apically, stigma dark red; spurs very pale reddish; markings of abdomen very clear-cut, very pale, faintly ochreous; basal band on first segment entire, apical band widely interrupted; transverse black band on first segment very broad, obliquely truncate at ends, its anterior margin undulate; band on second segment widely interrupted, the sections subclavate mesad, and laterally with a pointed projection, leaving the posterior lateral corners of the black very broadly rounded, and a little less open than a right angle;

band on third segment broken into four large transverse spots; band on fourth segment similar, but the median pair of spots narrowly united in middle; fifth with two patches only, connected in the middle by a bridge of brownish hair, and with the usual silvery lunule; second and third ventral segments thinly greyish-hairy, and with interrupted white bands, the sections placed obliquely.

Type: Female, No. 1613, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 24, 1920, at **Nanaimo Biological Station, British Columbia.**

In the interrupted abdominal bands, and widely separated stripes on mesothorax, this resembles *E. humillimus* Ckll., from Washington State. It will be recognized especially by the black antennæ, red tubercles, and coloration of legs. The markings of the mesothorax readily distinguish it from *E. asperatus* Ckll.

20. **Epeolus arciferus** Cockerell, new species

Female: Length about 8 mm.; black, including antennæ, labrum (which is shining), mandibles (except red band in middle), tubercles and axillæ; tegulæ obscure red, black at base; legs black with tibiæ at apex and the tarsi red; eyes deep olive green; light hair of mesothorax fulvous, in place of the two stripes a high broad arch resulting from the union of the stripes posteriorly. Allied to *E. geminatus*, but easily separated by the following characters; tibiæ black except at end; tegulæ much darker (clear red in *geminatus*); labrum black; hair on mesothorax (arch and margins) fulvous, the enclosed area in front not so sharply defined and not distinctly triangular, while the anterior arms of the arch, joining the margin, are very broad, and separated by only a short interval from the much more extended lateral patches; axillæ less prominent; marginal cell less truncate at end; hair of upper part of pleura ochreous, the lower part bare in middle, where it is densely punctured and shining between the punctures; hair band on posterior part of scutellum fulvous and entire (white and interrupted in *geminatus*); black transverse band on first abdominal segment with anterior margin straight; lower apical angles of black on second segment distinctly acute; band on fourth segment entire (on third with linear interruption). As in *E. geminatus*, the venter has white bands on segments 2 to 4, but that on second is emarginate anteriorly in middle.

Type: Female, No. 1614, Mus. Calif. Acad. Sci., collected by F. E. Blaisdell, in September, 1920, at **Pacific Grove, Monterey Co., California.**

21. **Epeolus pilatei** Cockerell, new species

Female: Length about 9 mm.; black, including antennæ, labrum (which is shining), base of mandibles (but rest red), tubercles, axillæ and legs (small joints of tarsi obscurely reddish); tegulæ black with obscurely red margin; eyes yellowish-green; pure white hair about base of antennæ; clypeus dull with no smooth line; vertex rugose; fulvous band of upper border of prothorax interrupted in middle; light hair of mesothorax, scutellum (the band entire) and postscutellum fulvous; stripes on mesothorax parallel, far apart, reaching margin not far from the large (triangular) lateral patches; posteriorly the stripes are united by a transverse band, so that they enclose a quadrate space; scutellum hardly bigibbous; axillæ rather prominent; basal area of metathorax bare; upper part of pleura covered with rather shaggy ochreous hair, lower part with a large round bare area, which is very densely punctured; wings strongly brownish, stigma black; marginal cell abruptly truncate; spurs dark; abdominal bands warm ochreous, basal one on first segment entire, but the apical broadly interrupted; transverse black band on first segment very broad, its anterior margin practically straight, its ends very broadly somewhat obliquely truncate; band on second segment more narrowly interrupted, its sections claviform, the lower apical corners of the black precisely rectangular, not rounded; band on third segment strongly undulate but not interrupted, on fourth similar; fifth with a pair of whitish patches and silvery lunule; venter with white bands on second and third segments.

Type: Female, No. 1615, Mus. Calif. Acad. Sci., collected by G. R. Pilate, October 25, 1909, at **San Pedro, California,** and presented to the Academy by Dr. E. C. Van Dyke.

Recognizable by the black legs and peculiar mark on mesothorax.

In addition to the above, there are four or five species of *Epeolus* represented by rather inadequate material, which have been set aside in the hope that more specimens will be obtained, permitting fuller or more accurate diagnoses.

The species of Epeolines recorded above may be readily separated thus:

Legs (at least femora and tibiæ) black.......................... 1
Legs (at least tibæ and tarsi) red.............................. 12
1. Females 2
Males 8

2. Black area on disc of first abdominal segment shorter than the distance from its ends to sides of segment; large species.. *T. concavus* (Cresson)
Black transverse area on disc of first abdominal segment much longer than distance from its ends to sides of segment; smaller species 3
3. Clypeus with a median smooth line............ *T. lineatulus* n. sp.
Clypeus without a median smooth line.......................... 4
4. Posterior lateral corners of black on second abdominal segment approximately rectangular 5
Posterior lateral corners of black on second abdominal segment pointed, much less than rectangular.......................... 7
5. Fifth abdominal segment with a large rounded flattened surface; larger species.............................. *T. vandykei* n. sp.
Fifth abdominal segment with an apical silvery lunule or band... 6
6. Tegulæ very dark, with dark reddish margins..... *E. pilatei* n. sp.
Tegulæ bright ferruginous................. *E. rubrostictus* n. sp.
7. Fifth abdominal segment with two round patches of brownish hair, connected in the middle, and no silvery lunule or band.. *E. heterurus* n. sp.
Fifth abdominal segment with an apical silvery lunule.. *E. arciferus* n. sp.
8. (Males). Abdominal segments beyond second with light spots instead of bands.......................... *E. melectimimus* n. sp.
Abdominal segments beyond second with entire bands............ 9
9. Dark area on disc of first abdominal segment small, not transverse .... *T. pallidiventris* n. sp.
Dark area on disc of first abdominal segment a broad transverse band 10
10. Lower lateral corners of black on second segment approximately rectangular; transverse black area on first segment comparatively short and broad, with oblique ends, and posterior middle angulate .... *E. heterurus* n. sp.
Lower lateral corners of black on second segment less than rectangular; transverse black area on first segment long and parallel-sided 11
11. Mesopleura largely dark; larger species......... *T. lineatulus* n. sp.
Mesopleura densely covered with white hair; smaller species.. *T. rectangularis* Ckll.
12. Femora black... 13
Anterior femora and tibiæ black, middle and hind femora and tibiæ red................................ *T. diversipes* n. sp.
Femora red 20

13. Females 14
Males 16
14. Bands on abdominal segments 3 and 4 divided laterally .... *E. rubrostictus* n. sp.
Bands on segments 3 and 4 not divided laterally 15
15. Light hair on anterior middle of mesothorax forming a V .... *E. geminatus* n. sp.
Light hair on mesothorax not forming a V *E. rufomaculatus* n. sp.
16. (Males). Apical plate of abdomen very broad; anterior marks on mesothorax contiguous .... *E. geminatus* n. sp.
Apical plate not thus broad, and mesothorax not thus marked in front 17
17. Apical plate clear bright red .... *E.* sp.
Apical plate dark 18
18. Mesothorax covered with pale hair .... *E.* sp.
Mesothorax not covered with pale hair 19
19. Transverse black area on first abdominal segment emitting median black bands anteriorly and posteriorly; pale hair above band on second segment extended mesad into sharp slender points .... *T. saturninus* n. sp.
Base of first abdominal segment before transverse band not broken by a black band .... *E. rufomaculatus* n. sp.
20. Females 21
Males 24
21. Basal pubescence of first abdominal segment broadly interrupted by a median dark band; scape entirely red.... *T. pectoralis* Rob.
Basal pubescence of first abdominal segment continuous right across 22
22. Clypeus entirely black .... *E.* sp.
Clypeus with lower edge red 23
23. Mesothorax covered with light hair *T. schwarzi subcalens* n. sub sp.
Mesothorax with a large bare patch; pygidial area red .... *T. hæmaturus* n. sp.
24. (Males). Posterior light band on first abdominal segment quite entire; spurs black 25
Posterior light band on first abdominal segment interrupted or deeply notched (in latter case mesothorax without well defined stripes) 28
25. Mesothorax with two well defined longitudinal pale bars; mesopleura covered with light hair; scape largely red .... *T. blaisdelli* n. sp.
(*T. mensæ* n. sp. if run here, is separated by the shorter, entirely black scape, but in pattern of mesothorax it falls better with the next division).
Mesothorax with more blurred or indistinct marking 26

26. Larger; black transverse band on first segment very slender.......
 ....*T. inyoensis* n. sp.
 Smaller; black band less slender.................................. 27
27. Eyes green..........................*T. schwarzi subcalens* n. sp.
 Eyes pale purplish grey........................*T. mensæ* n. sp.
28. Light longitudinal bars on mesothorax sharply defined........... 29
 Markings of mesothorax suffused or poorly defined; spurs red; scape black ....*T.* sp.
29. Scape pure black; abdominal bands ochreous....*T. pectoralis* Rob.
 Scape reddened; abdominal bands very pale...................... 30
30. Sides of second segment before band with large inwardly directed patches of pubescence....................*T. brunnescens* n. sp.
 Sides of second segment without such patches..............*E.* sp.

MELECTINÆ

22. **Zacosmia maculata** (Cresson)

California: San Diego, July 2-3, 1891. (Blaisdell); Colton, May 26-28, 1917 (Van Duzee). Females.

23. **Zacosmia maculata desertorum** Cockerell

California: Fresno Co., 1 ♂ (Van Dyke).

24. **Pseudomelecta pasadenensis** Cockerell

California: San Francisco Co., 1 ♀, 2 ♂ (Blaisdell).
The male differs from the male of *P. californica* in the same manner as the female. *Melecta sladeni* Viereck, Canad. Entom., LVI. Jan. 1924, appears to be identical with *P. pasadenensis,* the description showing no difference.

25. **Pseudomelecta californica** (Cresson)

Arizona: Cochise Co., June 23, 1916 (V. W. Owen). Oregon: Colestin (Van Duzee); Sparta and Warner Mts. (Van Dyke). California: Abundant and widely distributed; taken by E. P. Van Duzee at Millbrae, San Bruno Hills (San Mateo Co.), Berkeley, Pleyto, Mill Creek Canyon (San Bernardino Co.), Los Angeles, Colton, and Keen Camp (Riverside Co.). Taken by Dr. E. C. Van Dyke at Strawberry Valley (Eldorado Co.), hills back of Oakland, Yosemite Valley, Kings River Canyon, and Fallen Leaf Lake (Lake Tahoe); by F. E. Blaisdell at Mokelumne Hill, Pacific Grove, Poway (San Diego Co.) and San Diego; by J. A. Kusche in Sonoma Co.; by F. C. Clark at Santa Monica and Huntington Lake; by C. L. Fox at Mono Lake.

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XX[1]

EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA IN 1921[2]

CHRYSIDIDÆ FROM LOWER CALIFORNIA

BY

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Herein are listed or described the species of Chrysididæ contained in the lot of 14 specimens collected by the Expedition of the California Academy of Sciences to the Gulf of California in 1921. The family must be far better represented in this locality than this small collection would indicate, for the Pacific coast is rich in species. It is perhaps unwise to draw conclusions from the distributional data until more intensive collecting can be done, but the indications are that the Chrysidid fauna of this region is much the same as that farther north on the coast.

All the material representing the species listed here and including the types of three new species, was unfortunately destroyed in the mail while in transit to the California Academy of Sciences. The type of one of these species was unique and the description therefore cannot be published, but for the other two species new types have been selected and the descriptions modified accordingly.

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[1] No. 32 of the Gulf Expedition papers.

[2] A map showing all the islands, etc., visited by the Expedition will be found in Vol. XII, No. 6, of these Proceedings, copies of which can be supplied at 50 cents each.

November 29, 1924

1. **Notozus,** spp.

Two specimens, collected by E. P. Van Duzee, June 3, 5, 1921, at La Paz, Lower California.

In the absence of recent critical study of the genus Notozus in North America, it is impossible to ascribe names to the two specimens of this genus, representing apparently two species, which are before me. I am unable to identify them by means of Aaron's work (Trans. Amer. Ent. Soc., vol. 12, 1885, pp. 209-248) and do not care to describe them as new until this genus can be studied in its entirety.

2. **Parnopes concinna** Viereck

One specimen, collected by E. P. Van Duzee, June 4, 1921, at La Paz, Lower California.

3. **Parnopes westcotti** Melander & Brues

Three specimens, collected by E. P. Van Duzee, June 29, 1921, at Porto Refugio, Angel de la Guarda Island, Lower California; and May 29, 1921, at Loreto, Lower California.

4. **Chrysis (Holochrysis) sp.** [3]

One specimen, the type of a proposed new species, closely related to *Chrysis pacifica* Say, collected by E. P. Van Duzee, May 14, 1921, at Mulegé, Lower California. This specimen, being lost, obviously cannot be described. It is one of a rather numerous group all of which are commonly named *pacifica* in collections.

5. **Chrysis (Trichrysis) mucronata** Brullé

Two specimens, collected by E. P. Van Duzee, June 18, 1921, at Coyote Bay, Concepcion Bay, Lower California, and

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[3] In this and in the several species following, the subgeneric terminology of Lichtenstein (Petites Nouvelles Entomologiques, vol. II, 1876, p. 27) is employed, though there seems to be good ground for the abandonment of the commonly accepted subgenera, Holochrysis, Gonochrysis, etc. At a later date I hope to be able to present adequate reasons for this belief.

June 17, 1921, at Guadalupe Point, Concepcion Bay, Lower California.

This species has been recorded from California, Mexico, Brazil and Venezuela. I have examined a number of specimens from San José del Cabo, Lower California, collected by W. J. Fox and deposited in the collection of the American Entomological Society at Philadelphia. Aaron (loc. cit.) treats this species as a mere variant of *parvula* Fab., but the characters seem to be sufficiently distinct to separate them. The two species are very close, however.

6. **Chrysis (Tetrachrysis ?) tenuicornis** Taylor, new species

(Figures 2, 3, 4, 5)

This species, unrelated to any species of the genus that I have seen from any part of the world, and apparently unlike any yet described, is most remarkable by reason of its slender form, its long, straight mandibles, its unusually slender antennæ, the shape of its head, and, in particular, on account of the peculiar form of its abdominal tergites, the first of which is greatly shortened and the second greatly lengthened along the median line. The lost specimen from which I originally described this interesting species possessed six distinct apical teeth, two of which have become obsolete in the specimen which I now substitute and describe. The species is far removed from any sexdentate form and, indeed, is unlike any with four apical teeth that I know. Following previous authors' custom with such species, I am arbitrarily placing it under Tetrachrysis. This is but one of a number of species of Chrysis whose variations demonstrate the necessity of a less artificial classification of the genus.

Female. Length, 7.5 mm. Head: As seen from before, subquadrate, somewhat broader than high; as seen from above, broader than pronotum and nearly twice as long. Mandibles long, scarcely curved, with a small, blunt tooth subapically. Clypeus subequal in length to the vertical diameter of the antennal insertion, with an obtusely angulate, blunt projection at middle of anterior margin upon which is a deep transverse fossa, and with a strong longitudinal elevation which persists between the antennal insertions. Face broad below, narrow above, somewhat excavated medially; on both sides of the mid-portion transversely rugose; upper part and sides coarsely punctate. Facial carina straight, bent downward at both ends. Vertex subconvex; ocelli not hooded; ocellocular distance subequal to postocellar. Genæ broad; postorbital carina strong, doubly flexed, approaching very near the lower posterior orbit. Malar spaces fully twice the length of the second antennal article. Relative lengths of antennal articles,—2/10, 3/30, 4/15, 5/11.1.

Thorax: Pronotum extremely short, subperpendicular before, the dorsal portion scarcely longer than the metanotum; sides bisinuate, strongly converging before, when seen from above; median portion with a shallow, obsolescent, depressed area; lateral lobes with an elongate depression at the lower anterior end and a less distinct depressed area above. Scutum and scutellum convex. Metanotum convex, particularly posteriorly, a foveolate depression along its anterior margin. U-shaped groove of propodeum shallow and narrow; postero-lateral angles of propodeum small, acute, very divergent, their posterior surfaces broadly sublinear. Median longitudinal groove[4] of mesopleuron obsolete or nearly so; transverse groove[5] narrow and clear-cut, smoothest anteriorly, foveolate behind. Carinæ of lower mesopleuron subobsolete.

Abdomen depressed, tapering strongly apically. First segment subperpendicular and somewhat hollowed out before, the anterior surface bearing three shallow, smooth, divergent furrows, joined basally; posterior margin arched strongly forward so that it almost meets the summit of the anterior face of the segment—the first segment thus very short, when viewed from above. Second segment depressed, somewhat flattened longitudinally, its length along the median line unusually great—twice that of the lateral margin; posterior margin thickened, but its edge not hollowed out nor sharp; postero-lateral corners obtusely angled. Third segment much narrowed apically, roughly triangular in outline, flattened longitudinally and rather strongly depressed transversely, swelling before the groove at the sides but not medially. Groove shallow and narrow, obsolete medially and extending (though only faintly) to the base of the segment; pits small, regular, circular, the two medial ones out of alignment with and somewhat in front of the others. Four distinct, acute apical teeth, the two median ones long with an acute notch between them which is much deeper than the length of the teeth; the lateral teeth very small and sharply acute, pointing directly backward. Lateral emarginations between teeth somewhat bisarcuate, long and shallow, giving the appearance of a vestigial tooth and two shallow emarginations. Lateral margin of segment nearly straight.

Legs: Tarsal segments slender, scarcely dilated. Anterior femora barely grooved, smooth beneath. Tibiæ very long and slender.

Wings: Radial cell elongate, triangular; apex closed. Radial nervure rather sharply, but obtusely, angulate at about its middle.

Punctation: Very regular and uniform, nearly all the punctures being of somewhat less than one-half the diameter of an ocellus, considerably

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[4] The median longitudinal groove of the mesopleuron is the foveolate impression which in most species runs from the wing base diagonally to the sternum.

[5] The transverse groove of the mesopleuron is the foveolate impression which crosses the median longitudinal groove (see preceding footnote).

closer on the head and thorax than on the abdomen; shallow and somewhat confluent on third segment; interstices practically impunctate.

Color: Green, with strong bluish purple reflections. Venter immaculate. Wings slightly infuscated, darkest at the anterior edge of the radial cell.

Pubescence: Moderately long and sparse; erect on head and thorax, somewhat less so on abdomen.

Male. Unknown.

Type: Female, No. 1573, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, June 23, 1922, at **Steen Mountains, Harney Co., Oregon.**

The only additional specimen which I have seen, from which I originally described the species, was collected by E. P. Van Duzee, May 14, 1921, at Mulegé, Lower California. This differed markedly only in the possession of six, instead of four, distinct apical teeth, a difference which I believe could well occur in almost any species. Further collections from the two localities mentioned and also from intervening territory are highly desirable and essential to a better understanding of this strange species.

7. **Chrysis (Hexachrysis) fabricii** Mocsáry
(*sexdentata* Fab., not Christ)

Two specimens, collected by E. P. Van Duzee, April 23, 1921, at Fresh Water Bay, Tiburon Island, Sonora, and June 14, 1921, at Escondido Bay, Lower California.

This species has an unusually wide distribution. I have studied specimens from New Jersey, Georgia, Washington and Arizona, as well as from several interlying states. It has been reported by authors from South America (French Guiana, Surinam, Brazil).

8. **Chrysis (Hexachrysis) serrata** Taylor, new species

This species is very closely related to *clara* Cresson, to which it would be referred by Aaron's key (loc. cit.). I have compared the type of *clara* with it, however, and find it clearly distinct. It differs from Cresson's species in the beveled margins between the apical teeth, which in *clara* are thickened and hollowed out (fig. 1).

Female: Length, 8.5-10 mm. Head: Subelliptical, considerably broader than high, as seen from before; a little longer and broader than pronotum, as seen from above. Mandibles with a short, blunt, subobsolete tooth before the apex. Clypeus narrowly margined and deeply arcuato-emarginate before, a little shorter than the vertical diameter of the antennal insertion; its disc gibbous. Basin of face rather deeply excavated, finely transversely punctato-striate medially, with a median impressed line, the extreme sides with slightly larger, shallow, irregular punctures. Facial carina moderately protuberant, but not strong, its ends flexed downward. Ocelli distinctly hooded; ocellocular distance subequel to postocellar. Malar spaces moderately narrow, less than one-half as long as the second antennal article. Relative lengths of antennal articles 2/10, 3/13.6, 4/10.6, 5/8.3. Postorbital carina strong, reaching nearly as high as the summit of the eye, strongly arched and approaching very close to the lower posterior orbit.

Thorax: Pronotum about four-fifths as long as scutellum, very abruptly declivous before; median furrow narrow and shallow, obsolete behind; lateral lobes with a deep, subrhomboidal impression. Parapsidal lines of scutum somewhat broadened posteriorly, not deep or strong, somewhat confluent with the adjacent punctures. Disc of scutellum much flattened. Metanotum short, convex, with a small, impressed area in the anterior middle. U-shaped groove of propodeum broad and shallow, its lateral branches quite densely, but not strongly rugose; postero-lateral angles of propodeum sharp, acute, divergent, their posterior surfaces narrowly triangular, with a gentle obtusely angulate projection downward. Median longitudinal groove of mesopleuron narrow and shallow; transverse groove very deep, broad on disc, with sharp transverse rugæ; carinæ of lower mesopleuron moderately strong, subserrate, bowed out, forming together a very attenuated V.

Abdomen: First segment short, abruptly declivous before, the declivity bearing a moderately deep, rounded, median groove, which extends back of it; postero-lateral corners rectangulate, subspinoid. Second segment with a faint median carina, subconvex; posterior margin thickened, with the upper edge of the thickening sharp, projecting; postero-lateral corners subobtuse and subspinoid. Third segment short, subsemicircular in outline, a little transversely depressed across the middle and somewhat swollen before the groove. Groove narrow and deep, not very distinctly divided by the median carina, ending at about one-third of the distance from base to apex. Pits deep, close, circular, the separations between them very fine. Six acute apical teeth, slightly flexed downward, the two median long and narrow, the two lateral about half the length of these and much less acute, the medio-lateral about half way between the median and the lateral in length and acuteness; emarginations between teeth of subequal widths, the median deep, arcuato-angulate, the medio-lateral arcuate, more shallow, a little deeper than a semicircle, the lateral obliquely arcuate, still more shallow; emarginations beveled below, not hollowed out (fig. 1). Lateral margin rather gently arched inward along its entire length.

Legs: Femora with shallow grooves below; tarsal segments dilated apically.

Wings: Radial cell narrow; apex open; radial nervure very obtusely angled before its middle, the portion beyond the angulation straight.

Punctation: Vertex with rather close punctures of about one-third to one-half the diameter of an ocellus. Thorax with punctures of about one-half the diameter of an ocellus intermixed with a few very small punctures, particularly on the scutum; the interstices with sparse, fine punctules. Basal, median, and apical parts of first abdominal segment with rather large, deep punctures, the interstices rather densely punctulate; a patch of small, close punctures on both sides of the disc. Second and third abdominal segments with regular punctures, smaller than those on thorax, becoming somewhat smaller at the apices of both segments; interstices nearly impunctate.

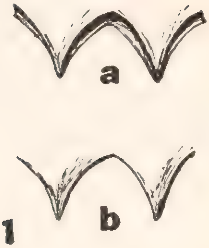
Color: Green, with brassy and limited, but brilliant, bluish-purple reflections. Venter green with brassy reflections, the basal part of the second segment black. Wings hyaline; radial cell somewhat infuscated.

Pubescence: Moderately short and sparse, silvery-white, a little longer on vertex, erect on thorax, subappressed on abdomen; moderately dense and subappressed on sides of face.

Male: Length, 8-10 mm. Differs only slightly from the female, chiefly in the third abdominal segment, which is shorter, often less depressed transversely, and has shorter apical teeth. Posterior ocelli less distinctly hooded. Pubescence of dorsum a little longer.

Type: Female, in Museum of Comparative Zoology, Harvard University, collected at **Pressy's, Wenass Valley, Washington.**

In addition, I have seen one female and five males of this species. The other female, from which I originally described the species, was collected by E. P. Van Duzee, June 3, 1921, at La Paz, Lower California. Allotype from Umatilla, Oregon, in Museum of Comparative Zoology. Other specimens; Mokelumne Hill, California (F. E. Blaisdell); Tallac (6000 ft.), El Dorado Co., California (W. M. Giffard); Washington (state).



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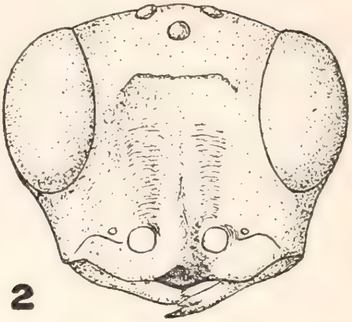

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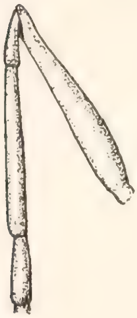

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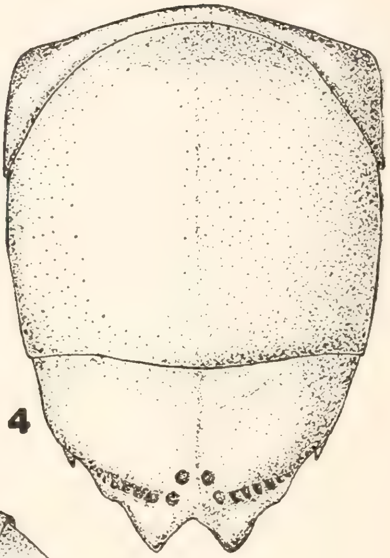

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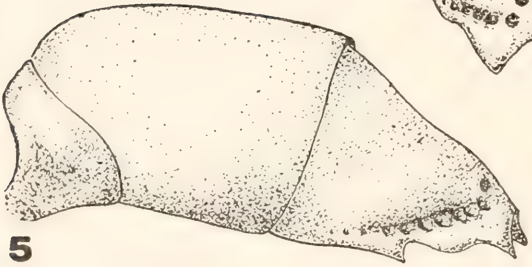

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EXPLANATION OF TEXT FIGURES

Fig. 1. Emargination between median apical teeth of (a) *Chrysis clara* Cresson and (b) *Chrysis serrata,* new species.

Fig. 2. *Chrysis tenuicornis,* new species. Head from before.

Fig. 3. Same. First four antennal articles.

Fig. 4. Same. Abdomen from above.

Fig. 5. Same. Abdomen from side.

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XXI[1]

EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA IN 1921[2]

THE BEES (III)

BY

GRACE SANDHOUSE and T. D. A. COCKERELL

University of Colorado

ANDRENIDÆ

Subfamily HALICTINÆ

The species of Halictus and Augochlora in the collection show a mixture of tropical and southwestern United States types. *Augochlora (Odontochlora) azteca* is a tropical species, while *A. pomoniella* was described from southern California, and is allied to species of the United States. *Halictus pseudopectoralis* was described from the tropical lowlands of Vera Cruz, but *H. microlepoides* was known from the Organ Mountains in southern New Mexico. *H. capitosus* is a species of the United States, but the tropical *H. townsendi* Ckll. is hardly more than a race. *Halictus desertus* Smith, a black species originally described from Oaxaca, was recorded by Fox from

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[1] No. 33 of the Gulf Expedition papers.

[2] A map showing all the islands, etc., visited by this Expedition will be found in Vol. XII, No. 6, of these Proceedings, copies of which can be supplied at 50 cents.

November 29, 1924

Lower Purisima, Lower California, but was not obtained by Mr. Van Duzee. For notes on Smith's type, see Trans. Amer. Ent. Soc., XXXI, p. 353.

Halictus Latreille

The species mentioned in this paper may be separated by the following key:

Species entirely black 1
Species with at least the head and thorax metallic (Chloralictus) 4
1. Males, apparently punctureless; disk of propodeum polished; flagellum testaceous beneath; knees and tarsi rufo-testaceous .... *chionocephalus,* n. sp.
—. Females 2
2. Large, 9-10 mm. long; cheeks armed .... *capitosus* Smith
—. Smaller; cheeks unarmed 3
3. Tegulæ black, punctured on inner margin; stigma and nervures dark; vertex closely punctured; head narrower .... *pseudopectoralis* Cockerell
—. Tegulæ not punctured; tegulæ, stigma and nervures pale testaceous; vertex without punctures; head broader .... *vanduzeei,* n. sp.
4. Females 5
—. Males 7
5. Abdomen metallic, color of thorax; disk of propodeum rather weakly reticulated .... *microlepoides* Ellis
—. Abdomen brown; disk of propodeum more strongly sculptured.. 6
6. Tegulæ punctured; mesothorax granular, finely punctured .... *tegulariformis* Crawford
—. Tegulæ not punctured; mesothorax shining, coarsely punctured .... *perdifficilis* Cockerell
7. Tegulæ punctured; mesothorax strongly punctured; abdomen dark brown .... *tegulariformis* Crawford
—. Tegulæ not punctured; mesothorax more weakly punctured; abdomen green .... *microlepoides* Ellis

108. **Halictus vanduzeei** Sandhouse & Cockerell, new species

Female: About 6 mm. long; black; pubescence white.

Head ordinary; facial quadrangle longer than broad; inner orbits converging below; antennæ black, the flagellum brownish beneath; entire face polished, the only punctures piliferous; sides of face and cheeks densely clothed with subappressed hairs; clypeus with a few coarse punctures, anterior margin fringed with yellowish hairs; mandibles reddish at the base, dark at the apex. Mesothorax, mesopleuræ and scutellum polished, with sparse piliferous punctures; tubercles with a yellowish spot; postscutellum covered with dense appressed hairs; disk of propodeum subcrescentic, striæ at sides radiating, on median portion irregularly anastomosing; apex of disk polished; tegulæ honey color, impunctate. Wings clear; anterior wing about 4 mm. long; stigma and nervures honey color; second cubital cell contracted almost one-half above, receiving the first recurrent nervure very near the apex; third cubital at least twice as long as second on marginal. Legs black, with dense white hairs, except on the inner sides of the tarsi where it is yellowish; hind spur pectinate with four teeth. Abdomen obovate, shining, impunctate; pubescence sparse, largely confined to the lateral bases of segments, but not in distinct clearly defined patches; apical margins of segments brownish.

Apparently closest to *pectoraloides* Cockerell, from which it differs by the paler stigma and tegulæ; disk of propodeum shorter, polished at the apex; bases of abdominal segments two and three without dense white patches of hair; cheeks with dense subappressed pubescence.

Habitat: Las Animas Bay, Lower California, May 8; La Paz, Lower California, June 5; Angeles Bay, Lower California, June 26. (E. P. Van Duzee), Six specimens.

Type: Female, No. 1545, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 5, 1921, at **La Paz, Lower California.**

109. **Halictus chionocephalus** Sandhouse & Cockerell, new species

Male: About 5 mm. long; black; appearing punctureless under a lens, but under the microscope a few fine punctures are visible; pubescence white.

Head subcircular; facial quadrangle as broad as long; face and cheeks covered with dense appressed, beautifully plumose hairs; cheeks somewhat angulate below; flagellum brown, yellow-testaceous beneath; second and third joints of antennæ of about equal length; mandibles long and slender, the bases yellow, becoming red at the apex. Thorax with moderately dense pubescence; tubercles with a yellowish spot; disk of propodeum polished, without sculpturing; truncation well defined laterally; tegulæ honey color, impunctate. Wings clear; stigma and nervures honey color; anterior wing about 3.2 mm. long; second cubital cell higher than broad, contracted above, receiving the first recurrent nervure very near the apex; third cubital at least twice as long as second on marginal. Legs black; knees and tips of tibiæ rufo-testaceous; tarsi testaceous. Abdomen shining, impunctate, sparsely pubescent; apical margins of segments brownish.

This species superficially resembles *H. vanduzeei*, and from the general resemblance might be considered to be the male of that species, but the sculpturing of the disk of the propodeum is quite distinct.

Readily distinguished from all species known to the writers by the polished body, without evident punctation, or sculpturing on the disk of the propodeum.

Type: Male, No. 1546, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, May 20, 1921, at **Loreto, Lower California.** One cotype from Animas Bay, Lower California, E. P. Van Duzee, May 8.

110. **Halictus microlepoides** Ellis

Male: About 4.5-5 mm. long; olive green; pubescence white, moderately dense.

Head ordinary; inner orbits converging below; antennæ brown, the flagellum yellow-testaceous beneath; second and third joints of antennæ of about equal length; vertex and front indistinctly punctured; clypeus and supraclypeal area shining, with a few coarse punctures; mandibles black. Mesothorax and scutellum shining, with moderately coarse punctures about twice the diameter of a puncture apart; mesopleuræ punctured; disk of propodeum sub-crescentic, shining, with a few striæ on the base, apex of disk polished; sides of propodeum punctured; truncation well defined laterally; tegulæ testaceous, impunctate. Wings clear; anterior wing 3.4 mm. long; stigma and nervures pale testaceous; third cubital cell about one and one-half times as long as second on marginal; second cubital cell receiving first recurrent nervure at the extreme apex. Legs black, except the knees, tips of tibiæ and tarsi which are red-testaceous. Abdomen very finely punctured; punctureless apical margins of segments narrow, dark testaceous.

In one of the specimens examined the left wing had only two cubital cells, while in the right wing the second transverso-cubital nervure did not meet the marginal or cubital nervures.

These specimens were taken from the same localities as female specimens of *microlepoides* and were found to resemble them very closely, except for sexual differences.

In an unpublished key of North American species of Halictus (Chloralictus) it runs to *albohirtus* Crawford, from which it differs by the green—not at all bluish—color; the more weakly punctured mesothorax, and disk of propodeum with sparser striæ.

Habitat: Tepoca Bay, Sonora, Mexico, April 25; San Lorenzo Island, May 9; Tortuga Island, May 11; San Esteban Island, April 19; Loreto, Lower California, May 20, (E. P. Van Duzee). Eight specimens.

The following records of specimens, taken by Mr. Van Duzee, are new:

111. **Halictus capitosus** Smith

Guaymas, April 8-11, 9 females;
San Nicolas Bay, May 16, 1 female.

112. **Halictus microlepoides** Ellis

Guaymas, April 7, 4 females;
Angeles Bay, May 5-7, 7 females;
Pond Island Bay, Angel de la Guarda Island, June 20, 1 female;
Willard's Point Bay, Tiburon Island, July 3, 3 females;
Freshwater Bay, Tiburon Island, April 25, 1 female;
Gonzales Bay, April 29, 2 females;
La Paz, June 3-5, 3 females;
San Evaristo, June 10, 1 female.

113. **Halictus perdifficilis** Cockerell

Guaymas, April 8, 1 female.

114. **Halictus tegulariformis** Crawford

Monserrate Island, June 23, 1 female;
La Paz, June 3, 3 males;
Mulegé, May 14, 1 male;
Gonzales Bay, April 29, 1 female;
Agua Verde, May 26, 2 females.
Originally described from Ormsby County, Nevada.

115. **Halictus pseudopectoralis** Cockerell

La Paz, June 4, 2 females.

AUGOCHLORA Smith

The species mentioned in this paper may be separated by the following key:

Females (with apical margins of abdominal segments black)........ 1
Males 2
1. First abdominal segment with a ventral dentiform process; first dorsal segment with close, strong punctures; disk of propodeum with radiating striæ *(Odontochlora)..azteca* (Vachal)
—. Characters as above, but the disk of propodeum with transverse striæ.......................*azteca transversalis,* new variety
—. First abdominal segment without such a ventral process; first dorsal segment without such strong punctures..*pomoniella* Cockerell
2. Margin of clypeus black, strongly truncate; disk of propodeum plicate; sides of propodeum with coarse punctures extending to the margin of the disk; first dorsal abdominal segment strongly punctured; flagellum obscure reddish beneath..*azteca* (Vachal)
—. Margin of clypeus yellow, gently rounded; disk of propodeum with irregularly anastomosing rugæ; sides of propodeum weakly punctured; first dorsal abdominal segment more weakly punctured; flagellum testaceous beneath..*pomoniella* Cockerell

116. **Augochlora azteca transversalis** Sandhouse & Cockerell, new variety

Female: Agrees with *A. azteca* (Vach.) in every respect excepting the sculpturing of the disk of the propodeum (fig. 1). In *azteca* the disk is covered with fine radiating striæ (fig. 2), while in this specimen the striæ are largely transverse. Intermediate specimens were also found—that is, with the striæ on the sides radiating, and those on the median portion irregularly transverse. The accompanying figures show the extreme types; Vachal's original specimen was somewhat intermediate. This variation far transcends what have ordinarily been considered specific limits in this genus, and is certainly most unusual, but our present judgment is that we have only one species before us. Described from the unique type.

Type: Female, No. 1547, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 5, 1921, at **La Paz, Lower California.**

The following records of specimens, taken by Mr. Van Duzee, are new:

117. **Augochlora azteca** (Vachal)

Guadalupe Point, Concepcion Bay, June 17, 2 females, 7 males;
San Nicolas Bay, May 16, 1 male;
Mulegé, May 14, 1 male and 1 female;
La Paz, June 3-5, 4 females.

118. **Augochlora pomoniella** Cockerell

Guaymas, April 10-11, 2 females;
La Paz, June 5, 1 female;
Concepcion Bay, June 17, 1 male;
Tiburon Island, April 23, July 3, 2 females and 1 male;
San Lorenzo Island, May 9, 1 female.

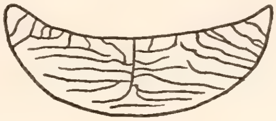

Figure 1.

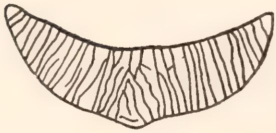

Figure 2.

BASAL AREA OF PROPODEUM.

Fig. 1. *Augochlora azteca transversalis.*
Fig. 2. *Augochlora azteca.*

PROCEEDINGS
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XXII

BEES OF THE GENUS OSMIA IN THE COLLECTION OF THE CALIFORNIA ACADEMY OF SCIENCES

BY
GRACE ADELBERT SANDHOUSE
University of Colorado

The Osmias in the collection of the California Academy of Sciences are chiefly from the Pacific Coast region and are the result of years of extensive collecting,—in most cases that of Mr. E. P. Van Duzee and Dr. E. C. Van Dyke. Before the study of this collection was undertaken, about 25 species of Osmia were known from this region. In the present lot are about 700 specimens, representing 64 species; of these 44 were species already known, leaving 20 new species. It has not been possible to do any matching of sexes from this region; so that the ultimate number of species must necessarily be reduced, probably to almost one-half of the present number. Twenty-seven of the species here recorded are known also from the Rocky Mountain region. At first this appears quite strange, but we find some of the species occurring in Utah and Idaho, and many in British Columbia; and when one considers the floras of these regions, this similarity of bee-faunas is not so strange.

In the Osmias of the Pacific Coast region one notes a predominance of dark pubescence, especially among the females, a striking contrast to the almost entirely pale pubescence of the Osmias of the eastern States. The Rocky Mountain

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Osmias are more intermediate forms; and it is usually the case that the darker species are the ones found to extend to the Pacific Coast region. One notes, moreover, the comparatively large number of species in the west as compared with the number in the east.

The writer has attempted to give keys to the species of the Pacific Coast region, and trusts they may be found useful in separating the species occurring there. The names followed by an asterisk are of those species known to me only from the descriptions. *O. californica* Cresson was omitted from the key as undoubtedly it must be a race of *O. lignaria* Say. In Professor Cockerell's collection the specimen named *californica* by Cresson and Titus has proved to be *O. wilmattæ* Cockerell; but Cresson's description of *californica* seems to be applicable to specimens of *lignaria* and cannot possibly be applied to *wilmattæ*.

The writer has examined the male genitalia of each species, and has found them to be distinctive. With a little practice the genitalia may be extracted without damaging the specimen, and they seem to be constant for the species. This has proved to be a useful check in the determination of species; and apparently will be of value in the formation of groups within the genus, which is quite necessary in a genus as large as Osmia. Some of the most striking cases are the following: the genitalia of the Acanthosmioides are similar within the groups, and quite different from those of the other groups; *universitatis* Cockerell and *vandykei* Sandhouse, show a relationship; as do also *kenoyeri* Cockerell and *paradisica* Sandhouse. In such cases the correlation of characters of the genitalia with external characters, such as modified middle tarsi, crenulate flagella, etc., is very clear; in some other cases the external characters are not so distinctive, and further study is needed before groups may be defined. The writer has extracted the genitalia from practically all the North American species, and hopes to be able to give figures and discussions of them in a later publication.

To Dr. Barton Warren Evermann and Mr. E. P. Van Duzee, the writer is greatly indebted for the opportunity of studying this material; and to Professor Cockerell of the University of Colorado, for the use of his collections which contain most of his type specimens of Osmia—and his literature with many manuscript notes, as well as for helpful criticisms and suggestions.

1. **Osmia vanduzeei** Sandhouse, new species

Male: About 15 mm. long; deep bluish grey-green; pubescence pale, except for some black hairs on dorsal segments 3-7 of the abdomen. Head ordinary; facial quadrangle a little longer than broad; inner orbits practically parallel; entire face clothed with a very dense pile of silky hairs so that the sculpturing is entirely concealed; the antennæ reach almost to the posterior margin of the mesothorax, scape black, flagellum strongly crenulate, dark ferruginous but paler beneath; anterior margin of clypeus shining black, truncate, fringed with white hairs; mandibles black, the bases obscurely greenish, apical tooth long. Thorax very closely and finely punctured; pubescence abundant; scutellum with a median polished line; disk of propodeum glaucous green, finely roughened; tegulæ black, punctured, anterior portion greenish, with tufts of pale hair. Abdomen shining; bases of segments with indistinct punctures, punctureless apical margins broad; sixth dorsal segment entire, weakly sinuate at the sides; seventh broadly notched; second ventral segment with a broad lamelliform process which is acutely uncinnate; third with a narrow emargination fringed with pale hairs; fifth weakly emarginate, with short yellowish hairs. Wings hyaline; anterior wing 9 mm. long; basal nervure just before nervulus; second cubital cell little longer than first on marginal; receiving first r. n. about 1/3 from base, and the second r. n. about 1/5 from apex. Legs metallic; tibial spurs curved at apex; hair on inner side of tarsi yellowish; apical tarsi dark ferruginous.

Type: Male, No. 1548, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, May 20, 1919, on **San Miguel Island, California.** *Paratype:* Keen Camp, Riverside Co., California, June 6-12, 1917 (E. P. Van Duzee).

2. **Osmia paradisica** Sandhouse, new species

Male: About 10-11 mm. long; nile green; except the face which is blue-green; pubescence pale, long and abundant on head and thorax. Facial quadrangle distinctly longer than wide, inner orbits practically parallel; anterior margin of clypeus truncate, fringed with white hairs; antennæ long, reaching the scutellum, flagellum very dark brown, dark ferruginous beneath; mandibles black, the apical tooth long. Mesothorax and scutellum shining between dense punctures; scutellum with a median polished streak; disk of propodeum dull blue-green; tegulæ dark brown, faintly metallic and punctured anteriorly. Abdomen shining; the bases of the segments with indistinct punctures; punctureless apical margins of segments polished, reddish brown; sixth dorsal segment entire; seventh notched; third ventral segment emarginate, fringed with short yellow hairs; second a little produced in the middle. Wings hyaline; basal nervure just behind nervulus; second cubital cell longer than first on marginal, receiving first r. n. more than ¼ from base, and the second r. n. about 1/5 from apex. Legs black; joints 2-5 of tarsi reddish; middle tarsi little modified; hind spurs long and curved; hind basitarsus much less modified than that of *kenoyeri* Ckll., but similarly flattened; hair on inner sides of tarsi fulvous.

Type: Male, No. 1549, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, July 19, 1920, at **Paradise Valley, Mount Rainier, Washington.**

3. **Osmia vandykei** Sandhouse, new species

Male: About 10 mm. long; dark blue, the face lighter and brighter blue. Eyes large, giving the head a broad appearance; inner orbits converging slightly below; face closely punctured, a polished streak extending down from the middle ocellus; anterior margin of clypeus black, truncate, fringed with pale hair; mandibles black, bidentate, the teeth subequal; antennæ about as long as the thorax; scape black, flagellum dark brown and flattened anterio-posteriorly, in front the lower half is dark testaceous; apical joint of flagellum broad and curved downwards to form an angle of almost 90 degrees; hair of face white, of cheeks black. Hair of dorsum of thorax largely denuded, but apparently all white; hair of pleura pale in front, of the posterior half and the sides of propodeum black; mesothorax and scutellum with close, rather coarse punctures; scutellum with a polished median streak; disk of propodeum dull blue, finely roughened; tegulæ brown, anterior portion blue and punctate. Dorsal abdominal segments largely denuded of hair, but that on the first segment and the base of the second apparently pale, that on the remaining segments black; abdomen shining, the only punctures piliferous; punctureless apical margins of segments obscurely reddish; margins of segments 1-4 narrow, of segments 5-6 almost half as wide as the segment; sixth dorsal segment entire, somewhat truncated; seventh broad, entire; median base of sixth segment, and the seventh with long black bristles; third ventral segment deeply notched, fringed with short, pale yellow hairs; first with a small notch. Wings hyaline; second cubital cell strongly contracted above, hardly longer than first on marginal, receiving first r. n. ⅓ from base, and the second r. n. ¼ from apex. Legs black, with black pubescence; the posterior femora and tibiæ obscurely metallic; joints 2-3 of middle tarsi thickened; hind tibial spurs broad, almost falcate.

Type: Male, No. 1550, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, June 18, 1922, at **Fremont National Forest, Klamath Co., Oregon.** *Paratype:* one male, same data.

4. **Osmia bakeri** Sandhouse, new species

Male: About 9-10 mm. long; blue-green; pubescence white. Head ordinary; inner orbits practically parallel; flagellum dark brown, dark ferruginous beneath; clypeus blue, with dense long hairs; anterior margin truncate; face densely punctured. Mesothorax and scutellum closely punctured; propodeum a darker blue-green than the thorax; tegulæ brown, the anterior portion metallic and punctate. Wings faintly dusky; basal nervure meeting the nervulus; second cubital cell little longer than the first on marginal, receiving the first r. n. ⅓ from base, and the second r. n. 1/5 from apex. Abdomen very closely punctured; punctureless apical margins of segments narrow on segments 1-3, wider on segments 4-6; sixth dorsal segment entire; seventh with a broad and shallow emargination; third ventral segment with a shallow emargination, fringed with yellow hairs. Legs black, obscurely metallic; inner side of tarsi with tawny hairs.

Easily distinguished from all species known to the writer by the peculiar seventh dorsal segment of the abdomen.

Type: Male, in collection of T. D. A. Cockerell, collected by C. F. Baker at **Claremont, California.** *Paratypes:* two males, same data; two males, Keen Camp, California, June 6-12, 1917 (E. P. Van Duzee).

5. **Osmia nemoris** Sandhouse, new species

Male: About 9 mm. long; bluish grey-green, usually with brassy tints; pubescence entirely pale, faintly yellowish to tawny. Head and thorax very closely punctured; head as wide as thorax; facial quadrangle subquadrate; inner orbits practically parallel; eyes large; flagellum black, obscurely ferruginous beneath; anterior margin of clypeus truncate, black; mandibles black, the apical tooth longer. Scutellum with a median polished streak; tegulæ black, greenish in front. Wings faintly dusky; basal nervure just behind nervulus; second cubital cell about one and one-half times as long as first on marginal, receiving the first r. n. ¼ from base, and the second r. n. less than 1/5 from apex. Abdominal segments with wide punctureless apical margins; bases of segments with quite close punctures; sixth dorsal segment subsinuate at the sides, produced in the middle, the extreme apex truncate; seventh rather broad, deeply notched, the two teeth very broad at apex; third ventral segment entire. Legs color of body; hind tibial spur straight; hind basitarsi toothed; apical tarsi dark ferruginous.

This species is superficially quite like *O. rustica* Cresson, with which it is sometimes confused, but it may be distinguished by the following characters: *O. rustica* has the sixth dorsal segment of the abdomen notched and not so produced in the middle; third ventral segment deeply emarginate; hind basitarsi not toothed; basal nervure before nervulus.

Type: Male, No. 1551, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, May 9, 1920, in **Muir Woods, Marin Co., California.** *Paratypes:* California: one male, Bryson, Monterey Co., May 18, 1920 (E. P. Van Duzee); one male, Pleyto, Monterey Co., May 22, 1920 (E. P. Van Duzee); two males, Claremont; one male, Palo Alto, April 6, 1892; one male, Mountain View, June. Washington: eight males, Olympia. Oregon: three males, Corvallis, June 10, 1892. Nevada: one male, Ormsby Co., July (C. F. Baker); British Columbia: one male, Vaseux Lake, June 14, 1919 (E. R. Buckell); one male, Fairview, May 18, 1919 (E. R. Buckell).

The paratypes are represented by specimens in the collections of the United States National Museum, Philadelphia Academy of Sciences, and Canadian Department of Agriculture.

6. **Osmia solitaria** Sandhouse, new species

Male: 10-11 mm. long; deep indigo blue; hair of head and thorax largely pale, of abdomen largely black. Head ordinary; hair of face and occiput pale, of cheeks pale, with a few black hairs intermixed, of vertex black; flagellum black; anterior margin of clypeus black, truncate, fringed with pale yellowish hairs; mandibles black, bidentate. Mesothorax very densely punctured; scutellum more coarsely and sparsely punctured; hair of dorsum of thorax white with a few black hairs intermixed; hair of pleura and sides of propodeum white; tegulæ black, anterior portion blue, punctate. Wings dusky hyaline; upper half of marginal cell fuliginous; basal nervure just behind nervulus; second cubital cell almost twice as long as first on marginal, receiving first r. n. about ¼ from base, and the second r. n. about 1/5 from apex. Abdomen robust, with indistinct punctures; punctureless apical margins of segments rather broad, purplish; first dorsal segment clothed with white hairs; on the bases of segments 2-6 the hair is black, with inconspicuous submarginal bands of pale hair; sixth dorsal segment entire; seventh notched; third ventral segment with a broad emargination, fringed with yellow hairs. Legs dark blue; hind basitarsi not toothed; pubescence black and white intermixed; the black hairs longer and more sparse than the white.

Type: Male, No. 1552, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 6-12, 1917, at **Keen Camp, Riverside Co., California.**

7. **Osmia enixa** Sandhouse, new species

Male: About 9-10 mm. long; robust blue-green species; hair of head and thorax abundant, pale except for a few black hairs on the cheeks; hair of first abdominal segment long and white, of segments 2-7 largely black on the bases of segments and pale on the apices; hair of legs largely black. Head as broad as thorax; inner orbits converging slightly below; antennæ rather short, reaching to the tegulæ, flagellum very dark ferruginous beneath, black above; anterior margin of clypeus truncate; mandibles bidentate, black, the apical tooth long. Mesothorax and scutellum dull, very closely and finely punctured; disk of propodeum dark blue, dull; tegulæ very dark brown, with a blue punctured spot in front. Wings hyaline; basal nervure behind nervulus; second cubital cell about one and one-half times as long as first on marginal, receiving the first r. n. little farther from base than the second r. n. from apex. Abdomen with greenish reflections, especially toward the apices of the segments; segments with indistinct punctures, the punctureless apical margins moderately broad; apical margin of sixth dorsal segment weakly notched, pale ferruginous; seventh broadly and deeply notched; third ventral segment apparently emarginate, but concealed by the second. Legs black, pubescence predominantly black, except on the femora which have some pale hairs; hind basitarsi toothed; hind spurs of tibiæ straight; apical tarsi dark ferruginous.

Type: Male, No. 1553, Mus. Calif. Acad. Sci., collected by J. C. Thompson, May 5, 1912, at **San Francisco, California.**

8. **Osmia aprilina atrovirens** Sandhouse, new subspecies

This variety from the Pacific coast states is very like the type of *aprilina* Cockerell, described from Boulder, Colorado, but differs in the following respects: some black hairs on face, in some cases the hair on the face is largely black; hair of cheeks with a large percentage of black hairs intermixed—a few in *aprilina;* hair of mesothorax and scutellum with at least as many black as white hairs; some black hairs on the pleura; color of tegument a darker green. The genitalia of *aprilina atrovirens* are apparently identical with those of *aprilina;* so this can hardly be a distinct species.

Type: Male, in collection of T. D. A. Cockerell, collected by C. F. Baker at **Claremont, California.** *Paratypes:* California: two males, Yosemite Valley, May 27, 1921 (E. C. Van Dyke); one male, Claremont (F. R. Cole); one male, Los Angeles Co. Nevada: one male, no data. Oregon: one male, Corvallis, June 18, 1899. Washington: 17 males, Seattle, April 4 to May 13, 1896. British Columbia: one male, Victoria, May 20, 1916 (R. C. Treherne).

The paratypes are represented by specimens in the collections of the California Academy of Sciences, United States National Museum, Canadian Department of Agriculture, and the Philadelphia Academy of Natural Sciences.

9. **Osmia peridonea** Sandhouse, new species

Male: About 9 mm. long; dark blue. Head as broad as thorax; antennæ black, as long as the thorax; hair of head all white, except some black hairs on the vertex and a few black hairs intermixed with the white on the cheeks; anterior margin of clypeus truncate, black. Dorsum of thorax dull, very closely punctured, pubescence long and white; scutellum with a median polished streak; hair of pleura largely black, with some white hairs about the tubercules; hair of sides of propodeum white; disk of propodeum a very dark, dull blue. Wings dusky; nervures black; basal nervure meeting nervulus; second cubital cell about one and one-half times as long as the first on marginal, receiving the first r. n. about 1/4 from base, and the second r. n. about 1/6 from apex. Abdomen robust, shining, with indistinct punctures; hair of first dorsal segment long and white, of second short and white, with some black hairs intermixed, of 3-6 black; punctureless apical margins of segments moderately broad, reddened; sixth and seventh dorsal segments strongly notched; third ventral segment emarginate. Legs black, the hind femora obscurely bluish; hair black, except some white hairs on the anterior femora.

Type: Male, No. 1554, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 6-12, 1917, at **Keen Camp, Riverside Co., California.** *Paratypes:* California: five males, same data as type; one male, Lower Lake, Lake Co., May 15, 1922 (E. P. Van Duzee).

10. **Osmia vana** Sandhouse, new species

Female: About 8 mm. long; brilliant green; pubescence, including scopa, white. Head normal; inner orbits converging slightly below; antennæ fuscous; entire face, including clypeus, with close but coarse punctures; clypeus and sides of face below insertion of antennæ bluish green; anterior margin of clypeus truncate, two brushes of orange hair beneath; mandibles tridentate, black, obscurely metallic at base. Mesothorax and scutellum shining between close, distinct punctures; the punctures of the scutellum a little farther apart; a median polished streak on scutellum; disk of propodeum concolorous with the thorax, dull, finely roughened; tegulæ brown, anterior portion green and punctate. Wings dusky hyaline; basal nervure meeting nervulus; first and second cubital cells equidistant on the marginal; second receiving first r. n. 1/4 from base, and the second r. n. 1/5 from apex. Abdomen shining, closely punctured; apical 1/5 of segments bluish; punctureless apical margins of segments very narrow; hair of apex of sixth dorsal segment fulvous. Legs metallic, more bluish green; hind tibial spurs slightly curved at the apex; hair on inner sides of basitarsi fulvous.

Differs from *O. granulosa* Cockerell, by the more coarsely punctured mesothorax and scutellum; tegulæ brown, with a greenish spot in front; color true green, rather than blue-green.

Differs from *gaudiosa* Cockerell, which has some black hairs on the face and mesothorax, and the tegulæ entirely metallic.

Type: Female, No. 1555, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, May 22, 1920, at **Pleyto, Monterey Co., California.** *Paratype:* San Mateo, California, July 4, 1911 (J. A. Kusche).

11. **Osmia kerminesina** Sandhouse, new species

Female: About 8 mm. long; species brilliant royal purple, including legs and tegulæ; pubescence black; scopa black. Head almost as wide as thorax; scape of antennæ purple, flagellum black; face with close, rather shallow punctures; clypeus more deeply punctured, the anterior margin black; mandibles black, tridentate, the bases purplish; hairs of lower cheeks long and curled. Mesothorax with coarse confluent punctures, on the disk the punctures are well separated, with minute punctures between the coarse punctures; scutellum coarsely and closely punctured, with a median polished streak; disk of propodeum concolorous with thorax; anterior margin of tegulæ punctured. Abdomen weakly punctured, the punctures largely piliferous; punctureless apical margins of segments moderately broad. Wings dusky; basal nervure going just basad of the nervulus; second cubital cell a little longer than the first on the marginal, receiving the first r. n. about 1/3 from base and the second r. n. about 1/5 from apex.

Type: Female, No. 1556, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 6-12, 1917, at **Keen Camp, Riverside Co., California.**

12. **Osmia læta** Sandhouse, new species

Female: 8.5-9 mm. long; blue-green, with purplish reflections; scopa black. Head and thorax with close, but shallow punctures; head ordinary; orbits converging slightly below; hair of face all black except patches of white at sides of face; antennæ black; hair of cheeks white with black intermixed; clypeus more deeply punctured, anterior margin black, truncate, two brushes of orange hair beneath; mandibles black, tridentate; few white hairs on occiput. Hair of thorax white, with some black hairs intermixed on mesothorax and scutellum; a median polished streak on scutellum; disk of propodeum concolorus with thorax, finely roughened; tegulæ metallic, anterior margin punctate. Wings fusco-hyaline; basal nervure just basad of the nervulus; second cubital cell a little longer than first on marginal, receiving first r. n. 1/4 from base, and the second r. n. 1/5 from apex. Abdomen shining, the only punctures piliferous; hair of first dorsal segment white, of segments 2-5 largely black, with some white in the sub-marginal region; apex of sixth segment with black hair; punctureless apical margins of segments rather narrow. Legs metallic; hair black, fuscous on anterior and median basitarsi; hind tibial spurs straight.

Type: Female, No. 1557, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, May 10, 1922, at **Blue Lakes, Lake Co., California.** *Paratypes:* California: two females, Santa Cruz, June 1-2, 1919 (E. P. Van Duzee); two females, Fallen Leaf Lake, July, 1915 (E. C. Van Dyke and L. S. Rosenbaum); one female, Fairfax, Marin Co., July 9, 1911 (E. C. Van Dyke); one female, Kelseyville, Lake Co., May 15, 1922 (E. P. Van Duzee); one female, Muir Woods, Marin Co., May 4, 1913 (E. C. Van Dyke); one female, Huntington Lake, July 4, 1919 (E. P. Van Duzee); two females, Yosemite Valley, June 9, 1921 (E. C. Van Dyke); one female, Oak Glen Lodge, San Bernardino Co., July (F. C. Clark); one female, Soboba Springs, Riverside Co., June 5, 1917 (E. P. Van Duzee). Oregon: one female, Fremont National Forest, Klamath Co., June 18, 1922 (E. C. Van Dyke).

13. **Osmia rostrata** Sandhouse, new species

Female: About 9-10 mm. long; steel-blue; scopa black. Head subquadrate, broader than thorax, closely punctured; hair black and white intermixed, except on the vertex where it is black; antennæ black; mandibles broad, quadridentate, black; clypeus depressed in the upper middle portion; anterior margin produced in the middle to form a snout-like process, the margin fringed with orange hairs. Dorsum of thorax closely and finely punctured, with black and white hairs intermixed; scutellum with a median polished streak; hair of pleura, and of sides of propodeum white; tegulæ very dark brown, anterior portion metallic and punctured. Wings dusky hyaline; marginal cell somewhat fuliginous, basal nervure just before nervulus; first and second cubital cells of about equal length on marginal, second receiving first and second r. n. at about equal distances from base and apex respectively. Abdomen subglobose, shining, indistinctly punctured, the punctures largely piliferous; punctureless apical margins of segments 1 and 2 narrow, of 3-6 moderately broad; first dorsal segment with long white hair, 2-6 with short black hair, a few inconspicuous pale hairs intermixed. Legs black, with black pubescence; hind tibial spurs stout.

Easily distinguished from all American Osmias known to the writer by the peculiar clypeus.

Type: Female, No. 1558, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, April 21, 1919, at **Stone Cañon, Monterey Co., California.** *Paratype:* Bradley, Monterey Co., California, May 22, 1920 (E. P. Van Duzee).

14. **Osmia exilis** Sandhouse, new species

Female: Small, slender species, about 7 mm. long; grey-green; pubescence, including scopa, white, except some tawny hairs on the hind tarsi. Head normal; inner orbits converging below; antennæ black; clypeus convex, shining between large, shallow punctures; anterior margin truncate; face more closely and finely punctured; mandibles tridentate; cheeks below with long curled hairs. Mesothorax with well-separated punctures; scutellum with larger, more shallow punctures; tegulæ black. Wings somewhat dusky; basal nervure behind nervulus; second cubital cell strongly contracted above, about as long as first on marginal, receiving first r. n. little farther from base than the second r. n. is from apex. Abdomen shining; bases of segments rather weakly punctured; punctureless apical margins of segments moderately broad; apex of sixth dorsal segment pruinose. Legs black; femora obscurely grey-green.

Distinguished from other species with pale pubescence, by the small slender body, and the long curled hairs on the cheeks.

Type: Female, No. 1559, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, May 16, 1922, at **Blue Lakes, Lake Co., California.** *Paratypes:* California: seven females, same data as type; one female, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee).

15. **Osmia seclusa** Sandhouse, new species

Female: About 10 mm. long; blue, with greenish reflections; scopa black; pubescence pale. Head subquadrate, broader than thorax, very densely punctured; inner orbits converging slightly below; antennæ black; hair of clypeus pale fuscous; anterior margin of clypeus truncate, with two tufts of orange hair beneath; mandibles broad, black, quadridentate, with fulvous hair. Dorsum of thorax very closely and finely punctured; scutellum with a median polished streak; disk of propodeum dull blue; tegulæ very dark brown, punctate in front. Wings dusky, especially the apical part; basal nervure just behind, or meeting nervulus; second cubital cell strongly contracted above, hardly longer than first on marginal, receiving first r. n. almost 1/3 from base, and the second r. n. about 1/5 from apex. Abdomen broad, very finely and closely punctured, the punctures becoming finer on the apical margins of the segments; pubescence more dense on apices of segments, appearing to be almost hairbands; sixth segment pruinose; punctureless apical margins of segments very narrow. Legs black; hair on inner side of tarsi fuscous.

Very similar in general appearance to *O. canadensis* Cr. and *cognata* Cr., and, therefore, may be a Monilosmia. Cresson has described a male Monilosmia, *O. inurbana*, from the Pacific Coast region; so this may prove to be conspecific with *inurbana*.

Distinguished from *canadensis* Cr., by the greenish color, blue in *canadensis;* black scopa, white in *canadensis;* anterior margin of clypeus entire; basal nervure behind nervulus.

From *cognata* Cr., by the more finely and densely punctured abdomen; very narrow punctureless apical margins of abdominal segments; no black hairs on dorsum of abdomen; basal nervure behind nervulus.

Type: Female, No. 1560, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, May 22, 1920, at **Pleyto, Monterey Co., California.** *Paratypes:* California: one female, same data as type; three females, Mokelumne Hill, May (F. E. Blaisdell); two females, Bradley, Monterey Co., May 22, 1920 (E. P. Van Duzee); five females, hills back of Oakland, May 8, 1910

(E. C. Van Dyke); one female, Inverness, May 22, 1910 (E. C. Van Dyke); one female, Muir Woods, Marin Co., May 9, 1920 (E. C. Van Dyke); one female, Poway, San Diego Co., April 2, 1885 (F. E. Blaisdell); two females, Sacramento; one female, Humboldt. Washington: three females; Pullman, July (C. V. Piper); Idaho: one female, Paris, July 8, 1920, No. F4741 (F. E. Lutz); Oregon: ten females, Corvallis, June 7-11, 1898 (H. Viereck); British Columbia: one female, Vancouver, June 16, 1896 (Livingston).

The paratypes are represented by specimens in the collections of the United States National Museum, Philadelphia Academy of Natural Sciences, and American Museum of Natural History.

16. **Osmia sedula** Sandhouse, new species

Female: About 9-10 mm. long; slightly greenish blue; hair of head and thorax largely pale; scopa black. Head large; inner orbits converging slightly below; antennæ black; entire face closely punctured; clypeus very dark blue; anterior margin of clypeus shining black, truncate; mandibles black, quadridentate; hair of cheeks white, with a few black hairs intermixed, on the lower half of the cheeks the hairs are longer; hair at sides of face pure white, of median portion of face and of occiput white with long black hairs intermixed, of vertex black. Thorax clothed with white pubescence, some black hairs intermixed on mesothorax and scutellum; mesothorax and scutellum dull, very densely punctured; a median polished streak on scutellum; tegulæ black, with a few punctures in front; disk of propodeum color of thorax, slightly roughened. Wings faintly dusky; basal nervure meeting nervulus; second cubital cell a little longer than the first on marginal, receiving the first r. n. about 1/3 from base, and the second r. n. hardly 1/5 from apex. Abdomen rather broad, with close but shallow punctures; punctureless apical margins of segments quite narrow; hair of first dorsal segment white, of bases of segments 2-5 black, with quite conspicuous marginal bands of pale hair; sixth segment with fuscous hair. Legs black, with black hair; hind tibial spurs curved at the apex.

Type: Female, No. 1561, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, April 26, 1919, at **Atascadero, San Luis Obispo Co., California.** *Paratypes:* California: four females, same data as type; one female, Ross, Marin Co., April 28, 1916 (E. P. Van Duzee); one female, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee); one female, hills back of Oakland, May 15, 1910 (E. C. Van Dyke). British Columbia: Nanaimo Biological Station, June 24, 1920 (Mrs. E. P. Van Duzee).

17. **Osmia celsa** Sandhouse, new species

Female: 11-12 mm. long; dark blue; scopa black; pubescence black, except for some white hairs on posterior side of propodeum, and first and second dorsal segments of abdomen. Head ordinary; antennæ black; inner orbits converging slightly below; face indistinctly punctured; clypeus black, anterior margin polished, truncate, two brushes of orange hair beneath; mandibles black, quadridentate; lower cheeks with long curled hairs. Mesothorax densely punctured, giving a rough appearance; scutellum with well-separated punctures, a median polished streak; disk of propodeum coriaceous; tegulæ black, the front punctured. Wings fusco-hyaline; marginal cell more deeply infuscated; basal nervure just before nervulus; second cubital cell about twice as long as first on marginal, receiving first r. n. at least 1/4 from base, and the second r. n. less than 1/6 from apex. Abdomen shining, indistinctly punctured; punctureless apical margin of first segment narrow, of segments 2-5 broader. Legs black; hind tibial spurs stout, curved at apex; femora shining black.

Type: Female, No. 1562, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 2, 1919, at **Santa Cruz, California.** *Paratype:* San Mateo, California, May 19, 1918 (E. P. Van Duzee).

18. **Osmia proposita** Sandhouse, new species

Female: About 13 mm. long; very dark blue; hair of head all black, except some white hairs intermixed on sides of face and between antennæ; hair of pleura black, of dorsum of thorax black and white, with varying amounts of the two colors; hair of sides of propodeum and of first abdominal segment pure white; hair of legs black, of abdominal segments 2-7 largely black, with a few inconspicuous white hairs, especially on the median base of second segment; scopa black. Head subquadrate, as broad as thorax; inner orbits converging slightly below; closely punctured, appearing almost granular; antennæ black, cheeks below with many long curled hairs; mandibles quadridentate; anterior margin of clypeus truncate, with two brushes of orange hair beneath. Mesothorax dull, very closely punctured, giving it a rough appearance; scutellum with coarser, more scattered punctures; disk of propodeum dull; tegulæ very dark brown, punctured, obscurely bluish in front. Wings dusky; upper half of marginal cell smoky; basal nervure before nervulus; second cubital cell twice as long as first on marginal, receiving first r. n. at least 1/4 from the base, and the second r. n. 1/6 from the apex. Abdomen rather shining, the bases of the segments with piliferous punctures; punctureless apical margins moderately broad. Legs black, hind tibial spurs curved at apex.

Superficially like *subpurpurea* Cockerell, from which it differs by the hair of pleura black; hair of cheeks all black, with many long curled black hairs below.

Type: Female, No. 1563, Mus. Calif. Acad. Sci., collected by E. C. Van Dyke, June 12, 1921, in **Yosemite Valley, California.** *Paratypes:* California: nine females, same data (June 9-30); one female, Huntington Lake, July 4, 1919 (E. P. Van Duzee); one female, Paradise Valley, Fresno Co., July 5, 1910 (E. C. Van Dyke); one female, Cayton, Shasta Co., July 11, 1918 (E. P. Van Duzee); one female, Carrville, Trinity Co., June 29, 1913 (E. C. Van Dyke); one female, Mokelumne Hill (F. E. Blaisdell); one female, Norval Flats, Lassen Co., May 31, 1920 (J. O. Martin); two females, Fallen Leaf Lake, July 12 and 23, 1915 (E. C. Van Dyke); one female, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee); two females, Kings River Cañon, Fresno Co., July 6, 1910 (E. C. Van Dyke); two females, Dunsmuir (Wickham). Washington: one female, Olympia, July 4, 1896; one female, Pullman, July 9 (C. V. Piper); one female, Blue Mountains, July 15, 1896 (C. V. Piper). Oregon: one female, Warner Mountains, Lake Co., June 19, 1922 (E. C. Van Dyke); three females, Fremont National Forest, Klamath Co., June 18, 1922 (E. C. Van Dyke). British Columbia: one female, Vernon, June 6, 1903; one female, Nanaimo Biological Station, June 24, 1920 (E. C. Van Dyke).

19. **Osmia visenda** Sandhouse, new species

Female: About 11-12 mm. long; dark blue; scopa black; pubescence black, except some white hairs on scutellum and first abdominal segment. Head normal; antennæ black; face indistinctly punctured; supraclypeal area with anastomosing punctures; anterior margin of clypeus truncate, black, two brushes of orange hair beneath; mandibles black, apically with ferruginous hair; quadridentate. Thoracic dorsum closely punctured; scutellum with a median polished streak; disk of propodeum dull, concolorous with the thorax; tegulæ metallic dark blue, anterior margin punctured. Wings dusky hyaline; basal nervure just basad of the nervulus; second cubital cell about one and one-half times as long as first on marginal, receiving the first r. n. 1/4 from base, and the second r. n. near apex. Abdomen shining, the punctures indistinct; punctureless apical margins of segments rather narrow. Legs black; hind tibial spurs stout, curved at apex.

Type: Female, No. 1564, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, July 4, 1919, at **Huntington Lake, Fresno Co., California.** *Paratypes:* California: one female, Tallac, El Dorado Co. (W. M. Giffard); one female, San Francisco, May 30, 1911 (E. C. Van Dyke). Idaho: one female, Montpelier, July 6, 1920, No. F4739 (F. E. Lutz, in collection of American Museum of Natural History).

20. **Osmia pellax,** Sandhouse, new species

Female: About 9 mm. long; dark purplish blue; scopa black; pubescence predominantly black. Head and thorax closely punctured; head ordinary; antennæ black, flagellum brown beneath; hair of head black, except some white hairs intermixed with the black on the face; anterior margin of clypeus truncate, two tufts of orange hair beneath; mandibles black, tridentate, the apical tooth long. Hair of dorsum of thorax white, with some black hairs intermixed, of pleura and sides of propodeum black; tufts of white hair behind the wings; tegulæ black, the anterior portion blue and punctate. Wings quite dusky; basal nervure meeting nervulus; second cubital cell a little longer than the first on marginal, receiving first r. n. 1/4 from base, and the second r. n. 1/5 from apex. Hair of first dorsal segment of abdomen white, of remaining segments black, except for a few inconspicuous white hairs on median base of second; punctureless apical margins of segments broad. Legs black, with black hairs.

Type: Female, No. 1565, Mus. Calif. Acad. Sci., collected by E. P. Van Duzee, June 6-12, 1917, at **Keen Camp, Riverside Co., California.** *Paratypes:* four females, same data.

Keys to the Osmias of the Pacific Coast region:

Males

—. Species brilliant, usually green or blue-green, sometimes purple *(cobaltina),* or with purplish reflections *(ribifloris)*............ 1

—. Species dark blue or green, the abdomen sometimes with tints of royal purple 5

1. Larger species; hair of pleura black; purple, or darker green, with purple tints 2

—. Smaller species; hair of pleura pale; pubescence largely or entirely pale; very brilliant green.................................... 3

2. Species purple; sixth dorsal segment of abdomen weakly notched; seventh dorsal segment strongly notched; pubescence in general more like bristles and shorter................*cobaltina* Cresson

—. Species green with purple tints; sixth dorsal segment of abdomen entire; seventh dorsal segment weakly notched; pubescence long and not at all bristle-like...................*ribifloris* Cockerell

3. Abdomen dorsally with some black hair; antennæ about as long as thorax .... *bennettæ* Cockerell

—. Abdomen dorsally with pale hair; antennæ shorter............... 4

4. Smaller golden green species, less than 6 mm. long; flagellum testaceous beneath; second cubital cell receiving the second r. n. almost as far from apex as the first r. n. from base........... ....*kincaidii* Cockerell

—. Larger blue-green species, 7-8 mm. long; flagellum dark ferruginous beneath; second cubital cell receiving first r. n. about twice as far from base as the second r. n. from apex......... .... *regulina* Cockerell

5. Second ventral segment of abdomen ending medially in a rounded lamelliform process; flagellum strongly crenulate beneath *(Acanthosmioides)* 6

—. Second ventral segment of abdomen without such a process; flagellum not crenulate beneath (moniliform in *inurbana)*...... 9

6. Flagellum light ferruginous, the last segment flattened and black; pubescence of abdomen black..................*ashmeadii* Titus

—. Flagellum of one color only, the last segment not so flattened; pubescence of abdomen pale or partly black, not all black....... 7

7. Species large, 14 mm. long, bluish grey-green; dorsal segments 3-7 of abdomen with black hair on the basal portion........... .... *vanduzeei* Sandhouse

—. Species smaller; olive-green, or dark blue-green................ 8

8. Olive-green; pubescence fulvous, nowhere with black hairs; hind basitarsi broad at the apex, and truncate *odontogaster* Cockerell

—. Dark blue-green; pleura posteriorly with some black hairs; hair of dorsal segments 3-7 of abdomen largely black.............. ....*nifoata* Cockerell

9. Middle tarsi thickened.. 10

—. Middle tarsi not modified.. 13

10. Middle tarsi little thickened, or hind basitarsi very broad; sixth dorsal segment of abdomen weakly notched; seventh dorsal segment strongly notched.................................... 11

—. Middle tarsi more strongly modified; hind basitarsi ordinary; sixth dorsal segment of abdomen entire; seventh dorsal segment entire, or broadly emarginate.................................. 12

11. Pubescence not all pale; hind basitarsi very broad, and broadly toothed; dorsal segments 3-7 of abdomen with pubescence largely black; middle of second ventral segment thickened apically ....*kenoyeri* Cockerell

—. Pubescence all pale; hind basitarsi less modified than above; second ventral segment of abdomen not so thickened apically ....*paradisica* Sandhouse

12. Apical joint of flagellum flattened; sixth and seventh dorsal segments of abdomen truncate, fringed with long black hairs; some black hair on the pleura...................*vandykei* Sandhouse

—. Flagellum ordinary; sixth dorsal segment of abdomen entire, but rounded, not truncate; sixth and seventh dorsal segments not so fringed with long black hairs; hair on pleura pale......... ....*universitatis* Cockerell

13. Pubescence entirely pale.. 14

—. Pubescence with some black hairs.............................. 21

14. Flagellum moniliform; hind basitarsi clavate; hind tibial spur long and curved *(Monilosmia)*...............*inurbana* Cresson

—. Flagellum ordinary; hind basitarsi not as above.................. 15

15. Sixth dorsal segment of abdomen entire; hind basitarsi apparently not toothed; head broad.......................... 16

—. Sixth dorsal segment of abdomen notched in the middle; hind basitarsi toothed; head ordinary.............................. 19

16. Sixth dorsal segment of abdomen truncate; seventh dorsal segment broad, with a very broad and shallow emargination; apical margins of abdominal segments concolorous with the bases..... ....*bakeri* Sandhouse

—. Sixth dorsal segment of abdomen rounded or produced in the middle; seventh dorsal segment acutely notched; apical margins of abdominal segments brownish or reddish..................... 17

17. Species very small, 5-5.5 mm. long; flagellum as long as thorax; sixth dorsal segment of abdomen rounded at apex, but not produced in the middle; second cubital cell contracted to about one-half above..*exigua* Cresson
(Specimens determined by the writer from the description.)

—. Sixth dorsal segment of abdomen produced in the middle, subsinuate at the sides; second cubital cell less strongly contracted 18

18. Legs black; tegulæ black; upper half of marginal cell smoky..... .... *davidsoniella* Cockerell

—. Legs green; tegulæ brown, with a green spot in front; marginal cell not smoky......................*nemoris* Sandhouse

19. Tegulæ and tibial spurs pale testaceous; flagellum pale rufo-testaceous .... *titusi* Cockerell
—. Tegulæ black or metallic; tibial spurs brown; flagellum brown or black 20
20. Upper half of marginal cell fuliginous; scutellum coarsely punctured; legs black.............................*texana* Cresson
—. Marginal cell quite clear; scutellum very closely and finely punctured; legs metallic...................*eutrichosa* Cockerell
21. Large species, 12-13 mm. long; sixth dorsal segment of abdomen broad; hair of dorsal segments 1 and 2 entirely pale; hair of thorax entirely pale..........................*integra* Cresson
—. Smaller species; sixth dorsal segment of abdomen rounded; pubescence not as above.. 22
22. Hair of pleura white (basitarsi toothed except for *seneciophila)* 23
—. Hair of pleura black, or with some black hairs present............ 29
23. Some black hairs on dorsum of thorax; legs metallic............. 24
—. No black hairs on dorsum of thorax; legs usually black (somewhat metallic in *wheeleri* and *mertensiæ,* which have no black hairs on thorax).. 25
24. Small green species, 8 mm. long; head broader than long; some black hairs on face........................*aprilina* Cockerell
—. Larger steel blue species, 10 mm. long; head ordinary; no black hairs on face.............................*solitaria* Sandhouse
25. Legs metallic; smaller species................................ 26
—. Legs black, with no metallic tints; larger species................ 27
26. Flagellum bright ferruginous beneath; pale olive-green species; some black hairs on vertex.................*mertensiæ* Cockerell
—. Flagellum dusky beneath; dark blue-green species; no black hairs on vertex...................................*wheeleri* Cockerell
27. Basal nervure before nervulus; marginal cell with a fuliginous streak in the upper half; sixth dorsal segment of abdomen strongly notched...........................*theta* Sladen MSS. (This species, which may prove to be the male of *O. subpurpurea* Cockerell, was named by Sladen in manuscript. A description of the type will be given by the writer in an early number of the Canadian Entomologist.)
—. Basal nervure behind nervulus; marginal cell without such a streak; sixth dorsal segment of abdomen weakly notched...... 28
28. Apical margin of sixth dorsal segment of abdomen pale ferruginous; pubescence of abdominal segments 3-6 black on the bases and pale on the apical portions..........*enixa* Sandhouse
—. Apical margin of sixth dorsal segment of abdomen not reddened; pubescence of segments 3-6 entirely black *seneciophila* Cockerell
29. Sixth dorsal segment of abdomen entire; hind basitarsi apparently not toothed; legs black.................................... 30
—. Sixth dorsal segment of abdomen notched; hind basitarsi toothed; legs somewhat metallic... 31

30. Dark green, or blue-green; seventh dorsal segment of abdomen entire; third ventral segment with a deep broad notch.......... *lignaria* Say

—. Dark blue; abdomen purplish blue; seventh dorsal segment of abdomen notched; third ventral segment hardly notched........ *montana* Cresson

31. Small species, less than 8 mm. long; head broader than long; sixth dorsal segment of abdomen weakly notched; hair of face black and white intermixed........... *aprilina atrovirens* Sandhouse

—. Larger species, 9-10 mm. long; head ordinary; sixth dorsal segment of abdomen strongly notched; apical margins of abdominal segments reddened, bases blue; hair of face all white.......... *peridonea* Sandhouse

Females

—. Brilliant species, usually blue-green, sometimes purplish, or with purple reflections 1

—. Species with at least the thorax dark blue or green, the abdomen sometimes a blue-purple........ 12

1. Scopa pale 2

—. Scopa black 3

2. Blue-green species; tegulæ purple; punctureless apical margins of abdominal segments very narrow.......... *granulosa* Cockerell

—. Golden green species; tegulæ brown with a green spot in front; punctureless apical margins of abdominal segments broader..... *vana* Sandhouse

3. Pubescence black 4

—. Pubescence largely pale, or at least with some pale hairs present.. 8

4. Robust species; usually dark green, sometimes purplish; pubescence long, not at all bristle-like........... *ribifloris* Cockerell

—. Normal or slender species; blue-green or a true purple; pubescence short and more bristle-like........ 5

5. Elongate species; head narrow, orbits parallel; hair of dorsum of thorax often reddish........ *fulgida* Cresson

—. Normal species; orbits usually converging slightly below; hair not at all reddish........ 6

6. Large blue-green species, 14 mm. long...... *viridimicans* Cockerell

—. Smaller royal purple species........ 7

7. Tegulæ entirely metallic; body all of one color; 8 mm. long; mesothorax shining between rather coarse punctures........ *kerminesina* Sandhouse

—. Tegulæ brown with a purple spot in front; clypeus, sides of face, and apical margins of abdominal segments a true purple, the rest of body a royal purple; 10 mm. long; mesothorax densely punctured .... *basilissa* Cockerell

8. Hair of pleura black.. 9

—. Hair of pleura white.. 10

9. Hair of face short and black; clypeus and sides of face below a true purple; species largely purple............*cobaltina* Cresson

—. Face with long black bristles; patches of white hair at the sides of the face; clypeus and sides of face dark blue-green; species largely blue-green..........................*bruneri* Cockerell

10. Legs brown, femora obscurely metallic, hair of legs pale; abdomen dorsally with pale pubescence, very closely punctured; punctureless apical margins of abdominal segments very narrow........ ....*regulina* Cockerell

—. Legs metallic, with pubescence largely black; some black hairs on dorsum of abdomen, more sparsely punctured; punctureless apical margins of abdominal segments broader................ 11

11. Larger, blue-green species; hair of face black, except for patches of white hair at the sides......................*læta* Sandhouse

—. Smaller, golden green species; white hairs on face not confined to the sides ....*kincaidii* Cockerell

12. Clypeus modified 13

—. Clypeus ordinary 20

13. Clypeus almost entirely polished and impunctate; mandibles very long; cheeks broad.. 14

—. Not so 15

14. Cheeks armed; hair of first dorsal segment of abdomen white, of dorsum of thorax largely white; patches of hair above the antennæ white...............................*armaticeps* Cresson

—. Cheeks unarmed; pubescence entirely black...*quadriceps* Cresson

15. Apical margin of clypeus very thick, otherwise unmodified........ ....*subornata* Cockerell (*Subornata* was considered by Cockerell to be a submelanic form of *megacephala* Cresson.)

—. Clypeus not thickened at the apical margin, emarginate or toothed; with a process in *rostrata*.................................... 16

16. Clypeus produced in the middle to form a process; not emarginate or toothed...............................*rostrata* Sandhouse

—. Clypeus emarginate or toothed.................................. 17

17. Clypeus broadly emarginate; hair of pleura black, of abdomen largely black, of head and thoracic dorsum largely black........ ....*lignaria* Say

—. Clypeus not so broadly or deeply emarginate, with two teeth; pubescence, exclusive of scopa, pale........................... 18

18. Scopa white; smaller, grayish blue-green species; abdomen with indistinct punctures......................*coloradensis* Cresson

—. Scopa black; larger, steel blue species; abdomen strongly punctured 19

19. Mandibles with a large basal tubercle.......*mandibularis* Cresson

—. Mandibles without such a tubercle................*faceta* Cresson

20. Scopa pale 21

—. Scopa black 22

21. Tegulæ and tibial spurs testaceous; larger, more robust species; hair of cheeks not long and curled............*titusi* Cockerell

—. Tegulæ and tibial spurs brown; small, slender species; hair of lower cheeks long and curled.................*exilis* Sandhouse

22. Pubescence, exclusive of the scopa, entirely pale, head broad; mandibles broad; species very closely and finely punctured..... ....*seclusa* Sandhouse

—. Some black hairs present, or pubescence entirely black; usually less densely punctured.. 23

23. Hair of pleura light.. 24

—. Hair of pleura black.. 28

24. (Some black hairs intermixed with the pale on dorsum of thorax) Face clothed with long black bristles; slender species........... ....*pentstemonis* Cockerell

—. Face with shorter hairs, hairs black and white intermixed; more robust species 25

25. Small species, 8 mm. long; flagellum dark ferruginous beneath; legs obscurely metallic.....................*phaceliæ* Cockerell

—. Larger species; 10 mm. long, or longer; flagellum black.......... 26

26. Large species, 13-14 mm. long; clypeus black; some long curled black hairs on lower half of cheeks......*subpurpurea* Cockerell

—. Smaller species; cheeks without such long and curled hairs...... 27

27. Blue species; mesothorax quite coarsely punctured; legs strongly metallic; tegulæ bluish.....................*clarescens* Cockerell

—. Blue-green species; mesothorax very finely punctured; legs black; tegulæ dark brown.........................*sedula* Sandhouse

28. Pubescence entirely black.. 29

—. Pubescence not entirely black, some white hairs present.......... 33

29. (The following portion in quotation marks is a key by Cockerell)[1]. "Legs at least partly metallic; clypeus and sides of face purple ....*gabrielis* Cockerell

—. Legs black, not metallic.. 30

30. Clypeus shining, with large well-separated punctures............ ....*nassa* Cockerell

—. Clypeus granular from minute punctures........................ 31

31. Mandibles tridentate ....*casta* Cockerell

—. Mandibles quadridentate 32

32. Abdomen deep purple, dullish.....................*cara* Cockerell

—. Abdomen rather steel-blue, shining............*putata* Cockerell"

33. Face clothed with long black bristles; tegument of front black, rough ....*wilmattæ* Cockerell

—. Face clothed with short hairs, no bristles on face; tegument of front not black and rough (*cyanosoma* has bristles shorter than *wilmattæ,* but is much smaller, legs metallic, tegument of front not black) 34

34. Legs metallic 35
—. Legs black, not metallic.. 37
35. Small species, about 7 mm. long; tegulæ brown, metallic in front; tufts of white hair behind wings..........*cyanosoma* Cockerell (*Cyanosoma* is very like *pentstemonis,* except for the darker pubescence.)
—. Larger species; tegulæ metallic; no tufts of white hair behind wings 36
36. Dark blue, without purple tints; scutellum without a median polished streak ....*cyanopoda* Cockerell
—. Dark blue, with purplish tints, especially on the lower half of face and apical margins of abdominal segments; scutellum with a median polished streak...................*sanctæ-rosæ* Cockerell
37. Cheeks with long curled black bristles............................ 38
—. Cheeks without such bristles.................................... 40
38. Hair of face entirely black; hair of thorax black, except for some white hairs on posterior surface of propodeum..*celsa* Sandhouse
—. Some white hairs on face; some white hairs on dorsum of thorax 39
39. Larger species, 13 mm. long; dark blue-green; white hairs intermixed with the black between the antennæ as well as on sides of face; abdomen densely punctured..........*proposita* Sandhouse
—. Smaller species, 10 mm. long; dark purplish blue; white hairs confined to the sides of the face; abdomen more sparsely punctured ....*pogonigera* Cockerell
40. Head subquadrate; cheeks broad.............................. 41
—. Head ordinary 43
41. Mesothorax dull black, with well-separated punctures; clypeus dull, and with punctation similar to that of the mesothorax.... .... *grinnelli* Cockerell
—. Mesothorax closely, and more finely punctured.................. 42
42. Clypeus closely punctured; hair of mesothorax white, with an interalar band of black hairs; marginal cell quite clear......... ....*wardiana* Cockerell
—. Clypeus shining between well-separated punctures; hair of mesothorax black and white intermixed, not banded; apex of marginal cell smoky..........................*pascoensis* Cockerell
43. Hair of dorsum of thorax pale................................. 44
—. At least some black hairs on the dorsum of thorax.............. 46
44. Hair of mesothorax and scutellum white; small species 8 mm. long ....*grindeliæ* Cockerell
—. Hair of mesothorax and scutellum fulvous; larger species, 11-16 mm. long 45
45. Very large, 16 mm. long; olive green; clypeus dull black, very densely punctured; punctureless apical margins of abdominal segments less than 1/4 as wide as segments.....*longula* Cresson

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[1] Pomona Journal of Ent. & Zool., Vol. VIII, No. 2, June, 1916, p. 54.

—. Smaller, 11 mm. long; blue-green; clypeus dark blue, less closely punctured; punctureless apical margins of abdominal segments about 1/3 as wide as segments..............*kenoyeri* Cockerell

46. Hair of face entirely black.................................. 47

—. Some white hairs on face.................................... 49

47. Small, green species, 7 mm. long; hair on sides of propodeum white ....*tristella* Cockerell

—. Larger, blue, or greenish blue species; hair on sides of propodeum black 48

48. Entire body dark blue; tegulæ metallic; hair of mesothorax and scutellum predominantly black; scutellum with a median polished streak ....*visenda* Sandhouse

—. Mesothorax blue-green; abdomen greenish blue; tegulæ black; hair of mesothorax predominantly pale; scutellum without a median polished streak......................*nigrifrons* Cresson

49. Entire sides of face clothed with pale hairs; hair of cheeks pale, with a few black hairs intermixed........................... 50

—. Sides of face with inconspicuous pale hairs, or white hairs confined to middle of face; hair of cheeks black.................. 51

50. Smaller, 8 mm. long; mesothorax and scutellum shining between rather close punctures; hair of scutellum white, with a few black hairs intermixed......................*melanopleura* Cockerell

—. Larger, 11 mm. long; mesothorax and scutellum dull, very densely punctured; hair of scutellum entirely pale.................. ....*nigrobarbata* Cockerell

51. Larger, 12-13 mm. long; mesothorax shining between distinctly separated punctures; supraclypeal area largely polished, with a few confluent punctures; marginal cell with a fuliginous streak ....*leonis* Cockerell

—. Smaller, not over 10 mm.; mesothorax densely punctured; supraclypeal area punctured; marginal cell without a fuliginous streak 52

52. Hair of mesothorax largely pale, with a few black hairs intermixed; blue-green species; hair of scutellum pale; mesothorax very finely punctured........................*pellax* Sandhouse

—. Hair of mesothorax largely, or entirely black; dark blue species; hair of scutellum largely black, with pale hairs on the apex; mesothorax more coarsely and roughly punctured (Specimens determined by writer from description)....*atrocyanea* Cockerell

The following records from the collection of the California Academy of Sciences are new:

21. **Osmia lignaria** Say

Kansas: 2 females, Lawrence, May 13, 1911 (F. X. Williams).
California: 17 females, Mokelumne Hill, March and April (F. E. Blaisdell);

7 females, Potholes, Imperial County, April 8, 1923 (E. P. Van Duzee);
2 females, Jamesburg, Monterey Co., May 17, 1920 (L. S. Slevin);
3 females, Yosemite Valley, May 12-24, 1921 (E. C. Van Dyke);
1 female, Santa Cruz, June 2, 1919 (E. P. Van Duzee);
1 female, San Anselmo, April 16, 1912 (E. P. Van Duzee);
3 females, Sobre Vista, Sonoma Co., April 20-May 12, 1910 (J. A. and A. V. Kusche);
14 females and 1 male, S. Sonoma Co., March 17-April 16, 1911 (J. A. Kusche);
2 males, Oakdale (J. G. Grundel).
Oregon: 4 females, Warner Lake, Lake County, June 19, 21, 1922 (E. C. Van Dyke).
British Columbia: 2 females, Nanaimo Biol. Station, June 23- 24, 1920 (E. P. Van Duzee).
Utah: 1 female, Mt. Timpanogos, July 8, 1922 (E. P. Van Duzee).

22. **Osmia montana** Cresson

California: 3 males, Yosemite Valley, May 22-June 28, 1921 (E. C. Van Dyke).
Oregon: 4 males, Fremont National Forest, Klamath Co., June 18, 1922 (E. C. Van Dyke).

23. **Osmia quadriceps** Cresson

California: 2 females, Mokelumne Hill (F. E. Blaisdell);
1 female, Blue Lakes, Lake Co., May 16, 1922 (E. P. Van Duzee);
1 female, Blue Lakes, Alpine County, Aug. (F. E. Blaisdell);
1 female, Sobre Vista, Sonoma Co., June 10, 1910 (J. A. Kusche);
1 female, Yosemite Valley, June 10, 1921 (E. C. Van Dyke);
2 females, Santa Cruz, June 6, 1919 (E. P. Van Duzee);
2 females, Guerneville, Sonoma County, May 31, 1910 (E. C. Van Dyke);
8 females, Fallen Leaf Lake, June 20-July 17, 1915 (E. C. Van Dyke and L. S. Rosenbaum);
Oregon: 1 female, Warner Mts., Lake County, June 19, 1922 (E. C. Van Dyke);
1 female, Hood River, June 12, 1920 (E. C. Van Dyke);
5 females, Fremont National Forest, Klamath County, June 18, 1922 (E. C. Van Dyke).

24. **Osmia armaticeps** Cresson

Oregon: 1 female, Steen Mts., Harney County, June 25, 1922 (E. C. Van Dyke);
1 female, Wallowa Mts., Baker County, July 5, 1922 (E. C. Van Dyke).

25. **Osmia ribifloris** Cockerell

California: 9 females, Mokelumne Hill, Feb. and Mar. (F. E. Blaisdell).
Arizona: 1 female and 1 male, Chiricahua Mts., Cochise County, March 26, 1917 (V. W. Owen).

26. **Osmia subpurpurea** Cockerell

Washington: 1 female, Longmire, Rainier National Park, July 27, 1920 (E. C. Van Dyke).
Oregon: 1 female, Sparta, Baker County, July 2, 1922 (E. C. Van Dyke);
1 female, Crater Lake, July 17, 1922 (E. C. Van Dyke).
British Columbia: 1 female, Nanaimo Biol. Station, June 24, 1920 (E. C. Van Dyke).
California: 9 females, Huntington Lake, July 5-17, 1919 (E. P. Van Duzee, F. E. Blaisdell and F. C. Clark);
1 female, Yosemite Valley, July 4, 1921 (E. C. Van Dyke);
1 female, Inverness, May 22, 1910 (E. C. Van Dyke);
3 females, Fallen Leaf Lake, July 13 and 19, 1915 (E. C. Van Dyke);
2 females, Pyramid Peak, El Dorado Co., Aug. 8, 1912 (E. C. Van Dyke).
Utah: 2 females, Salt Lake City, June 27, July 3, 1922 (E. P. Van Duzee).

27. **Osmia faceta** Cresson

California: 1 female, Bradley, Monterey Co., May 22, 1920 (E. P. Van Duzee);
1 female, Fairfax, May 25, 1919 (E. P. Van Duzee);
2 females, Yosemite Valley, June 13, 1921 (E. C. Van Dyke).
Oregon: 1 female, Colestin, Jackson Co., July 30, 1918 (E. P. Van Duzee).

28. **Osmia nassa** Cockerell

California: 1 female, Cisco, July, 1920 (Mrs. H. E. Ricksecker);
1 female, Goumaz, Lassen Co., July 17, 1919 (R. Hopping);
5 females, Fairfax, Marin Co., April 21, 1907 (E. C. Van Dyke);
6 females, Sobre Vista, Sonoma Co., May 8-July 12, 1910 (J. A. Kusche);
1 female, Mokelumne Hill (F. E. Blaisdell);
3 females, S. Sonoma Co., June 19-22, 1910 (J. A. Kusche);
1 female, Fallen Leaf Lake, July, 1915 (L. S. Rosenbaum);
1 female, Kings River Cañon, Fresno Co., July 7, 1910 (E. C. Van Dyke);
1 female, Santa Cruz Isd., May 18, 1919 (E. P. Van Duzee).

29. **Osmia gabrielis** Cockerell

California: 2 females, Mokelumne Hill (F. E. Blaisdell);
4 females, Sobre Vista, Sonoma Co., April 8-May 2, 1920 (J. A. Kusche);
1 female, Soboba Springs, Riverside Co., June 5, 1917 (E. P. Van Duzee);
1 female, Blue Lakes, Lake County, May 16, 1922 (E. P. Van Duzee);
1 female, Yosemite Valley, June 12, 1921 (E. C. Van Dyke);
1 female, Carrville, Trinity Co., July 22, 1913 (E. C. Van Dyke);
1 female, Mt. Tamalpais, Marin County, June 20, 1909 (E. C. Van Dyke);
2 females, San Francisco Co., April 20, 1913, and May 7, 1921 (E. C. Van Dyke and J. A. Kusche);
3 females, Bear Valley, San Bernardino Mountains, Aug. 1913 (F. C. Clark);
3 females, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee).

30. **Osmia pascoensis** Cockerell

California: 1 female, Blue Lakes, Lake Co., May 16, 1922 (E. P. Van Duzee);
1 female, Huntington Lake, Fresno Co. (F. C. Clark).
Oregon: 2 females, Hood River, June 12, 1920 (E. C. Van Dyke).

31. **Osmia wardiana** Cockerell

California: 3 females, Huntington Lake, Fresno Co., July 7-16, 1919 (E. P. Van Duzee and F. E. Blaisdell);
1 female, Kings River Cañon, Fresno Co., July 8, 1910 (E. C. Van Dyke);
2 females, Fallen Leaf Lake, July 1915 (L. S. Rosenbaum);
3 females, Warner Mts., Lake Co., June 19, 1922 (E. C. Van Dyke);
1 female, Yosemite Valley, June 30, 1921 (E. C. Van Dyke).
Oregon: 1 female, Steen Mts., Harney Co., June 24, 1922 (E. C. Van Dyke).
Utah: 1 female, Park City, July 2, 1922 (E. P. Van Duzee).

32. **Osmia nigrifrons** Cresson

California: 1 female, San Francisco, May 5, 1912 (J. C. Thompson);
1 female, Fairfax, May 11, 1919 (E. P. Van Duzee);
1 female, Stone Cañon, Monterey Co., April 21, 1919 (E. P. Van Duzee);
27 females, Cazadero, April 12, 1918 (E. P. Van Duzee).
British Columbia: 1 female, Nanaimo Biol. Station, June 24, 1920 (E. P. Van Duzee).

33. **Osmia leonis** Cockerell

Oregon: 1 female, Steen Mts., Harney Co., June 23, 1922 (E. C. Van Dyke).

34. **Osmia cobaltina** Cresson

Oregon: 1 female, Steen Mts., Harney Co., June 24, 1922 (E. C. Van Dyke).
California: 1 female, Fallen Leaf Lake, July, 1915 (L. S. Rosenbaum);
1 female, Claremont (C. H. Muzzall);
1 female, Huntington Lake, Fresno Co., July 16, 1919 (F. C. Clark).
Utah: 1 female, Logan, July 18, 1922 (E. P. Van Duzee);
2 females, Park City, July 2-3, 1922 (E. P. Van Duzee).

35. **Osmia regulina** Cockerell

California: 4 females, Pleyto, Monterey Co., May 22, 1920 (E. P. Van Duzee);
1 female, Cayton, Shasta Co., July 13, 1918 (E. P. Van Duzee);
1 female, Yosemite Valley, June 30, 1921 (E. C. Van Dyke);
18 females, S. Sonoma County, June 19 and July 1, 1910 (J. A. Kusche);
2 females, Alameda, May 12, 1918 (E. P. Van Duzee);
2 females, Blue Lakes, Lake Co., May 16, 1922 (E. P. Van Duzee);
1 female, Bryson, May 18, 1920 (E. P. Van Duzee);
1 female, Sacramento, May 27, 1918 (E. P. Van Duzee).

36. **Osmia pentstemonis** Cockerell

California: 1 female, Fallen Leaf Lake, July 2, 1915 (E. C. Van Dyke);
1 female, Huntington Lake, July 9, 1919 (F. C. Clark).
Washington: 1 female, Paradise Valley, Mt. Rainier, July 19, 1920 (E. C. Van Dyke).

37. **Osmia phaceliæ** Cockerell

California: 3 females, Pleyto, Monterey Co., May 22, 1920 (E. P. Van Duzee);
5 females, Huntington Lake, Fresno Co., July 7-20, 1919 (E. P. Van Duzee and F. E. Blaisdell);
1 female, Halseyville, Lake Co., May 15, 1922 (E. P. Van Duzee);
1 female, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee);
1 female, Mokelumne Hill, April (F. E. Blaisdell).
British Columbia: 2 females, Nanaimo Biol. Station, June 23, 1920 (E. P. Van Duzee).
Utah: 1 female, Park City, July 2, 1922 (E. P. Van Duzee);
2 females, Vivian Park, July 7, 1922 (E. P. Van Duzee).

38. **Osmia cyanosoma** Cockerell

California: 3 females, Yosemite Valley, June 9, 1921 (E. C. Van Dyke);
2 females, Fallen Leaf Lake, June 29, and July, 1915 (E. C. Van Dyke and L. S. Rosenbaum);
1 female, Paradise Valley, Fresno Co., July 15, 1910 (E. C. Van Dyke).
Washington: 2 females, North Bend, King Co., July 8-10, 1920 (E. P. Van Duzee).
Oregon: 1 female, Colestin, Jackson Co., July 30, 1918 (E. P. Van Duzee);
1 female, Hood River, June 12, 1920 (E. C. Van Dyke).
Utah: 1 female, Daniels Cañon, Heber, July 5, 1922 (E. P. Van Duzee);
1 female, Vivian Park, July 7, 1922 (E. P. Van Duzee).

39. **Osmia nigrobarbata** Cockerell

California: 1 female, Bradley, Monterey Co., May 22, 1920 (E. P. Van Duzee);
1 female, Stone Cañon, Monterey Co., May 27, 1919 (E. P. Van Duzee).

40. **Osmia kincaidii** Cockerell

California: 7 males and 1 female, Bryson, April 25-27, 1917 and May 16, 1920 (E. P. Van Duzee);
1 male, Keen Camp, Riverside Co., June 4-12, 1917 (E. P. Van Duzee);
2 males and 1 female, Fallen Leaf Lake, June 22 and July, 1915 (E. C. Van Dyke and L. S. Rosenbaum);
1 male, Stone Cañon, Monterey Co., April 21, 1919 (E. P. Van Duzee);
1 male, Blue Lakes, Lake Co., May 15, 1922 (E. P. Van Duzee);
2 males, Pleyto, Monterey Co., May 22, 1920 (E. P. Van Duzee);
1 female, Kelseyville, Lake Co., May 15, 1922 (E. P. Van Duzee);
1 female, Yosemite Valley, June 9, 1921 (E. C. Van Dyke).

41. **Osmia integra** Cresson

California: 1 male, San Francisco, April 20, 1913 (E. C. Van Dyke).

42. **Osmia universitatis** Cockerell

California: 1 male, Bryson, May 16, 1920 (E. P. Van Duzee).

43. **Osmia mertensiæ** Cockerell

California: 1 male, Yosemite Valley, June 28, 1921 (E. C. Van Dyke).

44. **Osmia wheeleri** Cockerell

California: 1 male, Fallen Leaf Lake, July 15, 1915 (E. C. Van Dyke);
1 male, Yosemite Valley, June 10, 1921 (E. C. Van Dyke);
1 male, Keen Camp, Riverside Co., June 6-7, 1917 (E. P. Van Duzee);
1 male, Huntington Lake, Fresno Co., July 7, 1919 (F. E. Blaisdell).

45. **Osmia theta** Sladen MSS.

California: 1 male, Fallen Leaf Lake, July 1915 (E. S. Rosenbaum);
1 male, Huntington Lake, Fresno Co., July 7, 1919 (F. E. Blaisdell).

46. **Osmia grindeliæ** Cockerell

California: 2 females, Bear Valley, San Bernardino Mts., Aug. 1913 (F. C. Clark).

47. **Osmia bennettæ** Cockerell

California: 1 male, Blue Lakes, Lake Co., May 16, 1922 (E. P. Van Duzee);
1 male, Santa Cruz, June 1, 1919 (E. P. Van Duzee).

48. **Osmia bruneri** Cockerell

Oregon: 2 females, Wallowa Mts., Baker Co., July 5, 1922 (E. C. Van Dyke);
1 female, Fremont National Park, Klamath Co., June 18, 1922 (E. C. Van Dyke);
1 female, Crater Lake, July 17, 1922 (E. C. Van Dyke).
Washington: 1 female, Paradise Valley, Mt. Rainier, July 20, 1920 (E. C. Van Dyke).
California: 1 female, near Nellie Lake, Fresno Co., July 25, 1919 (E. P. Van Duzee).

49. **Osmia subornata** Cockerell

Utah: 1 female, Park City, July 3, 1922 (E. P. Van Duzee).

50. **Osmia mandibularis** Cresson

Utah: 1 female, Vivian Park, July 7, 1922 (E. P. Van Duzee).

51. **Osmia viridimicans** Cockerell

Oregon: 1 female, Wallowa Mts., Baker Co., July 5, 1922 (E. C. Van Dyke).

52. **Osmia nifoata** Cockerell

Utah: 1 male, Park City, July 2, 1922 (E. P. Van Duzee)

53. **Osmia eutrichosa** Cockerell

California: 1 male, Yosemite Valley, June 26, 1921 (E. C. Van Dyke);
1 male, Huntington Lake, July 1, 1919 (F. C. Clark).

54. **Osmia aprilina** Cockerell

California: 1 male, Mokelumne Hill, May (F. E. Blaisdell);
1 male, Yosemite Valley, June 10, 1921 (E. C. Van Dyke).

55. **Osmia clarescens** Cockerell

California: 1 male, Santa Cruz Isd., May 17, 1919 (E. P. Van Duzee).

56. **Osmia coloradensis** Cresson

California: 2 females, Fallen Leaf Lake, June 29, and July 19, 1915 (E. C. Van Dyke);
1 female, Sisson, July 25, 1918 (E. P. Van Duzee);
1 female, Yosemite Valley, July 7, 1921 (E. C. Van Dyke).
Oregon: 1 female, Warner Mts., Lake Co., June 19, 1922 (E. C. Van Dyke).
Utah: 8 females, American Fork Cañon, July 25, 1922 (E. P. Van Duzee);
5 females, Park City, July 2, 1922 (E. P. Van Duzee);
1 female, Vivian Park, July 7, 1922 (E. P. Van Duzee).

57. **Osmia wilmattæ** Cockerell

California: 5 females, Huntington Lake, Fresno Co., July 4-21, 1919 (E. P. Van Duzee, Mrs. E. P. Van Duzee, F. E. Blaisdell, and F. C. Clark);
1 female, Paradise Valley, Fresno Co., July 15, 1910 (E. C. Van Dyke);
1 female, Kings River Cañon, Fresno Co., July 6, 1910 (E. C. Van Dyke);
1 female, Yosemite Valley, June 9, 1921 (E. C. Van Dyke);
2 females, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee);
1 female, Mokelumne Hill (F. E. Blaisdell);
1 female, Soboba Springs, Riverside Co., June 1, 1917 (E. P. Van Duzee).
1 female, Huntington Lake, July 7, 1919 (E. P. Van Duzee).
Utah: 8 females, Park City, July 2-3, 1922 (E. P. Van Duzee);
4 females, Vivian Park, July 7, 1922 (E. P. Van Duzee);
1 female, Logan, July 15, 1922 (E. P. Van Duzee);
2 females, Salt Lake City, July 1, 1922 (E. P. Van Duzee).

58. **Osmia fulgida** Cresson

California: 1 female, Yosemite Valley, July 7, 1921 (E. C. Van Dyke).
Utah: 1 female, Park City, July 3, 1922 (E. P. Van Duzee);
1 female Parley Cañon, Salt Lake City, June 24, 1922 (E. P. Van Duzee);
2 females, Logan, July 15, 1922 (E. P. Van Duzee);
1 female, Mt. Timpanogos, July 8, 1922 (E. P. Van Duzee).

59. **Osmia texana** Cresson

California: 1 male, Bryson, Monterey Co., May 19, 1920 (E. P. Van Duzee);
1 male, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee).

60. **Osmia seneciophila** Cockerell

California: 2 males, Fallen Leaf Lake, June 20 and July 14, 1915 (E. C. Van Dyke);
1 male, Huntington Lake, Fresno Co., July 5, 1919 (F. C. Clark).
Oregon: 2 males, Steen Mts., Harney Co., June 24, 1922 (E. C. Van Dyke);
1 male, Warner Mts., Lake Co., June 19, 1922 (E. C. Van Dyke).

61. **Osmia melanopleura** Cockerell

California: 9 females, Huntington Lake, Fresno Co., July 4-8, 1919 (E. P. Van Duzee and F. C. Clark).

62. **Osmia kenoyeri** Cockerell

California: 1 female, San Francisco, May 5, 1912 (J. C. Thompson);
1 female, Kings River Cañon, Fresno Co., July 8, 1910 (E. C. Van Dyke).
Washington: 1 female, Paradise Valley, Mt. Rainier, July 17, 1920 (E. C. Van Dyke).

63. **Osmia putata** Cockerell

California: 1 female, Huntington Lake, Fresno Co., July 8, 1919 (E. P. Van Duzee);
1 female, San Francisco, May 27, 1911 (J. A. Kusche).

64. **Osmia basilissa** Cockerell

California: 20 females, Bear Valley, San Bernardino Mts., August, 1913 (F. C. Clark);
1 female, Keen Camp, Riverside Co., June 6-12, 1917 (E. P. Van Duzee);
1 female, S. Sonoma Co., June 19, 1910 (J. A. Kusche);
2 females, Fallen Leaf Lake, July 23-4, 1915 (E. C. Van Dyke);
1 female, Huntington Lake, Fresno Co., July 16, 1919 (F. C. Clark);
4 females, S. Fork, Kings River, July 8, 1910 (E. C. Van Dyke).

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

FOURTH SERIES

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XXIII[1]

EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA IN 1921[2]

CRUSTACEA (Brachyura)

BY

MARY J. RATHBUN

U. S. National Museum

The collection of Brachyura made by the 1921 Expedition of the California Academy of Sciences to the Gulf of California contains several notable occurrences, although special attention was not given to this group in the field. Especially valuable are the specimens of the two species of Epialtus which are rare and little known. Several species are represented by larger specimens than have hitherto been recorded. One small female belongs to an undescribed species of Goetice which was first detected in the collections made by the *"Albatross"* in the same region in 1911; it is noted herein as No. 12 and a description will appear in a forth-coming Bulletin of the American Museum of Natural History.

In addition to the collection from the Gulf of California the following report contains notices of three species (Nos. 2, 5, 21), from Abreojos Point, on the west coast of Lower Cali-

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[1] No. 35 of the Gulf Expedition papers.

[2] A map showing all the islands, etc., visited by this Expedition will be found in Vol. XII, No. 6, of these Proceedings, copies of which can be supplied for 50 cents.

November 29, 1924

fornia and one species (No. 11) from Guadalupe Island, off the west coast, all taken by Dr. G. Dallas Hanna in 1922.

1. **Dromidia larraburei** Rathbun

Dromidia sarraburei [error] RATHBUN, Proc. U. S. Nat. Mus., Vol. 38, 1910, p. 553, pl. 48, fig. 4.

Patos Island anchorage, April 23, 1921, 4½ fathoms; one male and one juv.; Fred Baker, coll.

2. **Hepatus kossmanni** Neumann

Hepatus kossmanni NEUMANN, Catal. Pod. Crust. Heidelberger Mus., 1878, p. 28.

Abreojos Point, July 31, 1922; one male; G. D. Hanna, coll.

A large specimen, carapace 81 mm. long, 110.4 mm. wide; covered with small, unequal, crowded rings of red, which partly run together and reticulate; similar but larger rings are on the dorsal surface of chelipeds and legs.

3. **Portunus (Achelous) minimus** Rathbun

Portunus (Achelous) minimus RATHBUN, Proc. U. S. Nat. Mus., Vol. 21, 1898, p. 595, pl. 44, fig. 3.

San Jose Island, one ovigerous female.

Ballandra Bay, Carmen Island, May 22, 1921; 8 fathoms; three males and two females; Fred Baker, coll.

Mejia Island; one male; Fred Baker, coll.

This male is about twice the size of the type-specimen; carapace with a total length of 21 mm. and a total width of 35.5 mm.

4. **Callinectes bellicosus** (Stimpson)

Lupa bellicosa (SLOAT, ms.) STIMPSON, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1859, p. 57.

Callinectes bellicosus, ORDWAY, Boston Journ. Nat. Hist., Vol. 7, 1863, p. 577.

Angeles Bay; one ovigerous female; Fred Baker, coll.

Angeles Bay, bay shore; two males; I. M. Johnston, coll.

5. **Cancer antennarius** Stimpson

Cancer antennarius Stimpson, Proc. Cal. Acad. Sci., Vol. 1, 1856, p. 96.

Abreojos Point, July 31, 1922; one female; G. D. Hanna, coll.

6. **Xanthodius hebes** Stimpson

Xanthodius hebes Stimpson, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1860, p. 208.

San Carlos Bay, Sonora, March 9, 1921; one male; Fred Baker, coll.

7. **Eurypanopeus planus** (Smith)

Panopeus planus Smith, Proc. Boston Soc. Nat. Hist., Vol. 12, 1869, p. 283.

Eurypanopeus planus A. Milne-Edwards, Crust. Rég. Mex., 1880, p. 321, pl. 59, figs. 4-4*c*.

San Carlos Bay, Sonora, March 9, 1921; one male; Fred Baker, coll.

8. **Micropanope areolata** Rathbun

Micropanope areolata Rathbun, Proc. U. S. Nat. Mus., Vol. 21, 1898, p. 588.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; three males and one female; Fred Baker, coll.

9. **Pilumnus gonzalensis** Rathbun

Pilumnus gonzalensis Rathbun, Proc. U. S. Nat. Mus., Vol. 16, 1893, p. 240.

Tepoca Bay, April 25, 1921; two juvenile females; Fred Baker, coll.

Gulf of California; 1921 Expedition; one male.

10. **Eriphia squamata** Stimpson

Eriphia squamata Stimpson, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1859, p. 56.

San Marcos Island, on kelp, June, 1921; one male without chelipeds; Ivan Johnston and Fred Baker, colls.

Gulf of California; 1921 Expedition; one male and one female.

11. **Pachygrapsus crassipes** Randall

Pachygrapsus crassipes Randall, Jour. Acad. Nat. Sci. Phila., Vol. 8, 1839 (1840), p. 127.

Jack's Bay, Guadalupe Island, July 16, 1922; one male and one ovigerous female; G. D. Hanna, coll.

12. **Goetice,** species

Tepoca Bay, April 25, 1921; one female; Fred Baker, coll.

13. **Sesarma (Holometopus) magdalenense** Rathbun

Sesarma (Holometopus) magdalenense Rathbun, Bull. 97, U. S. Nat. Mus., 1918, p. 305, pl. 86.

Espiritu Santo Island, lagoon, two males; 1921; Fred Baker, coll.

These specimens are considerably larger than those of the type lot; the larger carapace measures 15.4 mm. long, 17.8 wide between outer angles of orbit, 17.2 wide between postero-lateral angles.

14. **Uca princeps** (Smith)

Gelasimus princeps Smith, Trans. Conn. Acad. Arts & Sci., Vol. 2, 1870, pl. 2, fig. 10, pl. 3, figs. 3-3c.

Uca princeps, Rathbun, Bull. 97, U. S. Nat. Mus., 1918, p. 382, pl. 133, pl. 160, fig. 6.

Ballandra Bay, Carmen Island, May 22, 1921, 8 fathoms; one male; Fred Baker, coll.

15. **Uca crenulata** (Lockington)

Gelasimus crenulatus Lockington, Proc. Cal. Acad. Sci., Vol. 7, 1876 (1877), p. 149.

Uca crenulata, Holmes, Occas. Papers Cal. Acad. Sci., Vol. 7, 1900, p. 75, pl. 1, figs. 7-9.

Ballandra Bay, Carmen Island, 8 fathoms; one male; Fred Baker, coll.

Tepoca Bay, April 25, 1921; one male; Fred Baker, coll.

16. **Uca musica** Rathbun

Uca musica Rathbun, Proc. U. S. Nat. Mus., Vol. 47, 1914, text-fig. 5, pl. 10.

Tepoca Bay, April 25, 1921; five males and one female; Fred Baker, coll.

17. **Stenorynchus debilis** (Smith)

Leptopodia debilis Smith, Rept. Peabody Acad. Sci. for 1869 and 1870, appendix (1871), p. 87.

Stenorynchus debilis Rathbun, Proc. U. S. Nat. Mus., Vol. 21, 1898, p. 568.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; two females; Fred Baker, coll.

18. **Podochela latimanus** (Rathbun)

Ericerus latimanus Rathbun, Proc. U. S. Nat. Mus., Vol. 16, 1893, p. 224.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; two males and two females; Fred Baker, coll.

19. **Epialtus sulcirostris** Stimpson

Epialtus sulcirostris Stimpson, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1860, p. 198.

San Marcos Island, on kelp, June, 1921; two males; Ivan Johnston and Fred Baker, colls.

Larger male, length of carapace 11 mm., width 9 mm. This exceeds Stimpson's type.

In this species the rostrum ends in a short point or spine; the rostrum itself is subtriangular, very thick, the under surface much smaller than the upper, the lateral surfaces deeply sulcate. Palms of chelipeds short and high, upper edge laminate. The propodus of the first ambulatory leg has at its distal fourth below a small shallow prominence bearing a few short hairs.

20. **Epialtus minimus** Lockington

Epialtus minimus Lockington, Proc . Cal. Acad. Sci., Vol. 7, 1876 (1877), p. 77.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; one male; Fred Baker, coll.

This specimen has a total carapace-length of 16.8 mm., width across hepatic regions 12.5 mm., across branchial regions 12.2 mm.

Rostrum elongate, tip bilobed. Palms of chelipeds elongate, upper margin lobulate. The propodus of the first ambulatory leg has one, of the other legs, two sockets below, from which proceed a few hairs which simulate a spine.

21. **Libinia setosa** Lockington

Libinia setosa Lockington, Proc. Cal. Acad. Sci., Vol. 7, 1876 (1877), p. 68.

Abreojos Point, July 31, 1922; eight males and four females; G. D. Hanna, coll.

22. **Herbstia camptacantha** (Stimpson)

Herbstiella camptacantha Stimpson, Ann. Lyc. Nat. Hist. N. Y., Vol. 10, 1871, p. 94.

Herbstia camptacantha, A. Milne-Edwards, Crust. Rég. Mex., 1875, p. 78, pl. 18, figs. 3-3*e*.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; one female; Fred Baker, coll.

This little specimen has a soft hairy shell and is so damaged that it cannot be identified with certainty. It belongs, however, to the group having the antennal spine long and the rostral spines long, regularly tapering and divergent. The legs are transversely banded with an orange color, when preserved; the propodal articles are longer and slenderer than in the young of *H. parvifrons* Randall.

23. **Thoe sulcata** Stimpson

Thoe sulcata STIMPSON, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1860, p. 177.

Tepoca Bay, April 25, 1921; one male; Fred Baker, coll.

With chelipeds not fully developed.

24. **Anaptychus cornutus** Stimpson

Anaptychus cornutus STIMPSON, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1860, p. 184, pl. 2, figs. 1-1b.

Tepoca Bay, April 25, 1921; two females; Fred Baker, coll.

Encrusted with sponges, serpulids, ascidians and bryozoans. The larger specimen is a little larger than the type, measuring 27.3 by 32.8 mm.

25. **Pitho picteti** (Saussure)

Othonia picteti SAUSSURE, Rev. et. Mag. de Zool., ser. 2, Vol. 5, 1853, p. 357, pl. 13, fig. 2.

San Jose Island; 1921 Expedition; one male.

26. **Microphrys platysoma** (Stimpson)

Milnia platysoma STIMPSON, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1860, p. 180.

Microphrys platysoma, A. MILNE-EDWARDS, Crust. Rég. Mex., 1875, p. 62.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; one male; Fred Baker, coll.

PROCEEDINGS

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XXIV[1]

EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA IN 1921[2]

CRUSTACEA (Marcrura and Anomura)

BY

WALDO L. SCHMITT

U. S. National Museum

Although special attention was not given to the collecting of Crustacea by the 1921 Expedition, some species of very considerable value were obtained. Representatives of two species were found which were first detected as being new in the course of working up the material collected by the *"Albatross"* Expedition of 1911. Descriptions of these will appear in a forth-coming Bulletin of the American Museum of Natural History. They are numbers 18 and 19 of the present list.

In addition to the collection from the Gulf of California the following list includes one species (No. 6) taken on Guadalupe Island, off the west coast of Lower California by Dr. G. Dallas Hanna in 1922, and one species (No. 12) from a freshwater stream in the Sierra Laguna Mountains of Lower California, collected in 1919 by Mr. Joseph R. Slevin.

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[1] No. 36 of the Gulf Expedition papers.

[2] A map showing all the islands, etc., visited by this Expedition will be found in Vol. XII, No. 6, of these Proceedings, copies of which can be supplied for 50 cents.

November 29, 1924

1. **Cœnobita compressus** Guérin

Cœnobita compressa Guérin, Voy. autour du Monde sur la *Coquille* par Duperrey, Zool., Vol. 2, pt. 2, 1831, p. 29.

Punta Gordas, Ceralbo Island, July 6, 1921; one specimen; Fred Baker, coll.

Monserrate Island, May 25, 1921; one female; V. Owen, coll.

2. **Clibanarius digueti** Bouvier

Clibanarius digueti Bouvier, Bull. Mus. Hist. Nat. Paris, Vol. 4, 1898, p. 378.

San Carlos Bay, Sonora, 1921; 32 specimens; Fred Baker, coll.

3. **Clibanarius panamensis** Stimpson

Clibanarius panamensis Stimpson, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1859, p. 84.

Puerto Escondido, May 24, 1921; two males; Fred Baker, coll.

4. **Dardanus sinistripes** (Stimpson)

Pagurus sinistripes Stimpson, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1859, p. 82.

Salt Works, San Jose Island, June 20, 1921, 2 fathoms; two males; Ivan Johnston and Joseph Chamberlain, colls.

5. **Pagurus benedicti** Bouvier

Eupagurus minutus Benedict, Proc. U. S. Nat. Mus., Vol. 15, 1892, p. 14 (not *Paguru minutus* Hess, 1887).
Eupagurus benedicti Bouvier, Bull. Mus. Hist. Nat. Paris, Vol. 4, 1898, p. 381.

Salt Works, San Jose Island, June 10, 1921, 2 fathoms; one male; Ivan Johnston and Joseph Chamberlain, colls.

6. **Pagurus samuelis** (Stimpson)

Eupagurus samuelis Stimpson, Proc. Boston Soc. Nat. Hist., Vol. 6, 1857, p. 86.

Pagurus samuelis Schmitt, Univ. Calif. Pub. Zool., Vol. 23, 1921, p. 139, pl. 16, figs. 2 and 3, text fig. 90a, b.

Guadalupe Island; one male; G. D. Hanna, coll.

This is the first record of this species south of San Diego.

7. **Petrolisthes gracilis** Stimpson

Petrolisthes gracilis Stimpson, Ann. Lyc. Nat. Hist. N. Y., Vol. 7, 1859, p. 74.—Schmitt, Univ. Calif. Pub. Zool., Vol. 23, 1921, p. 181, pl. 32, fig. 4.

Tepoca Bay, April 25, 1921; one male and one female; Fred Baker, coll.

San Carlos Bay, Sonora, July 9, 1921; three specimens; Fred Baker, coll.

In general this species is not unlike *P. eriomerus* Stimpson[8] which also is listed from Lower California; but aside from the fact that the merus of the ambulatory legs is almost, if not wholly nude, and that the carpus of the chelipeds is smoother and more elongate, the greater extent of the hairiness on the inner side of the movable finger of the chelipeds will invariably distinguish the two forms. In *P. gracilis,* the under side of the movable finger is clothed with long hair nearly to the tip; in *P. eriomerus,* on the movable finger it appears to be confined to the proximal half of the finger, the distal moiety if at all pubescent is devoid of long hair, being usually quite naked and more or less evenly rounded off beneath.

8. **Petrolisthes hirtipes** Lockington

Petrolisthes hirtipes Lockington, Ann. Mag. Nat. Hist. (5), Vol. 2, 1878, p. 397.

Tepoca Bay, April 25, 1921; one female; Fred Baker, coll.

This is a much flattened species, unmistakably characterized by Lockington, and, until the present, not since recorded from the Gulf of California. Lockington's "several specimens" were "dredged in five fathoms Mulegé Bay, Gulf of California; also at Port Escondido."

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[8] *Ann. Lyc. Nat. Hist. N. Y., Vol. 10, 1871, p. 119.*

9. **Petrolisthes hirtispinosus** ? Lockington

Petrolisthes hirtispinosus Lockington, Ann. Mag. Nat. Hist. (5), Vol. 2, 1878, p. 400, (not *Petrolisthes edwardsi* Saussure).

Tepoca Bay, April 25, 1921; one male and two females; Fred Baker, coll.

As Lockington surmised his *P. hirtipes* is undoubtedly distinct from *P. edwardsi*. In the latter the inner margin of the carpus of the chelipeds carries but three teeth; in *P. hirtispinosus,* the carpus is armed "with four or five large triangular teeth in front, ending in spines followed by more spinose tubercles at the distal end."

The specimens from Tepoca Bay are very near, if not identical with, the species described by Lockington. Except for the fact that he states, "surface of chelipeds covered with squamose ridges with a crenulate edge, and thickly pubescent," the specimens from Tepoca Bay fit his description very closely. When the pubescence is rubbed off, such ridges are found to occur only on the outer, rather posterior half of the carpus and on the "large triangular teeth" on its anterior margin. The general surface of the hand shows no such ridges, being covered with small imbricating scales with seemingly crenulate edges, due to the insertion of the stiff hairs with which the free border of each little scale is margined. Occasional scales are somewhat raised up, virtually forming small tubercles, which, under ordinary conditions, are hidden by the pubescence of the hand.

From the presence of the squamose ridges on the carpus and the fact that in addition to "the longitudinal ridge on the carpus . . . formed of prominent oblique squamæ," the "manus" has a similar longitudinal line passing into a line of tubercles down the center of the dactylus, but formed, however "of a row of longitudinal crenulate squamose teeth," it is probable that Lockington assumed that squamose ridges were also present on the palm beneath the pubescence covering its upper surface. The only ridges on the hands other than the row of longitudinal teeth just mentioned, are those running up from beneath across the hinder border of either palm to form the raised "interior margins."

10. **Pachycheles panamensis** ? Faxon

Pachycheles panamensis Faxon, Bull. Mus. Comp. Zoöl., Vol. 24, 1893, p. 175; Mem. Mus. Comp. Zoöl., Vol. 18, 1895, p. 71, pl. 15, fig. 2, 2a.

Tepoca Bay, April 25, 1921; two males and two females; Fred Baker, coll.

These specimens differ slightly from the published description and figure of the species given by Faxon. The hands are more hairy than the description or figure appear to admit. The internal distal angle of the merus of the smaller cheliped is produced as a feebly denticulated tooth, the same angle of the merus of the larger cheliped forming a blunter lobe, a condition of affairs just the reverse of that described and figured by Faxon. The toothing of the carpus is as described; the figure of *P. panamensis,* however, is not wholly in agreement with the description.

From Holmes's *P. pubescens* this Tepoca Bay material differs in that the pubescence is made up more largely of longer hairs, and, though thick, is not so brushy or felted as the generally shorter pubescence of that species. Also the larger hand is proportionately longer in *P. panamensis?* than in *P. pubescens;* in the latter the movable finger is shorter than the greatest width of the hand, while in the former the movable finger of the larger hand is longer than the greatest width of the hand. Beneath the pubescence the hands of *P. panamensis?* are less coarsely and not so prominently granulate as in *P. pubescens.* The fingers are gaping and lack the tuft, or dense brushy growth of hair found between the fingers of *P. pubescens.* Like that species the telson is composed of seven plates: a central (triangular), two terminal, and two lateral, each of which has a smaller plate separated off at its proximal end.

11. **Macrobrachium mexicanum** (Saussure)

Palæmon mexicanus Saussure, Mem. Soc. Phys. Hist. Nat. Genève, Vol. 14, 1858, p. 468 (52), pl. 4, fig. 27, 27*a*.

Mulegé, May 14, 1921; 19 specimens from fresh water above tide level, upper part of town; Joseph Chamberlain, Ivan Johnston, and Fred Baker, colls.

It seems to me that this is very likely the species reported from this locality by Bouvier as *Palæmon forceps* M. Edw. Bouvier[4] also described a new species, *Macrobrachium (Palæmon) digueti,* at the same time[5], but so far as I am aware the latter species has not been taken since, nor do specimens of it exist in any American collection.

12. **Macrobrachium jamaicense** (Herbst)

Cancer (Astacus) jamaicense Herbst, Natur. Krabben u. Krebse, Vol. 2, 1792, p. 57, pl. 27, fig. 2.

Guamuchi Ranch, Sierra Laguna Mountains, Cape Region, fresh water; five males; Joseph R. Slevin, coll.

13. **Palæmon ritteri** Holmes

Palæmon ritteri Holmes, Proc. Cal. Acad. Sci. (2), Vol. 4, 1895, p. 579, pl. 21, figs. 29-35.

Ballandra Bay, Carmen Island, May 22, 1921, 8 fathoms; one specimen; Fred Baker, coll.

14. **Periclimenes tenuipes** (Holmes)

Anchista tenuipes Holmes, Occas. Papers Cal. Acad. Sci., Vol. 7, 1900, p. 216.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; seven specimens; Fred Baker, coll.

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[4] Bull. Mus. Hist. Nat. Paris, Vol. 1, 1895, p. 160.

[5] Op. cit. p. 159, text fig. 1, 2.

Just as the several Gulf of California specimens examined by Miss Rathbun[6] "agree with Holmes's description, except that the fingers of the second pair of feet are only a little over half as long as the palm and the posterolateral angle of the sixth abdominal segment is subacute" so do these specimens from Patos Island.

15. **Hippolyte californiensis** Holmes

Hippolyte californiensis Holmes, Proc. Cal. Acad. Sci. (2), Vol. 4, 1895, p. 576, figs. 21-26.

Patos Island, anchorage, April 23, 1921, 4½ fathoms; two specimens; Fred Baker, coll.

16. **Betæus longidactylus** Lockington

Betæus longidactylus Lockington, Proc. Cal. Acad. Sci., Vol. 7, 1877, p. 35.

Tepoca Bay, April 25, 1921; one male and one ovig. female; Fred Baker, coll.

This is the first record of the occurrence of this species south of San Diego, its type locality.

17. **Sicyonia penicillata** Lockington

Sicyonia penicillata Lockington, Bull. Essex Inst., Vol. 10, 1878 (1879), p. 164.

Ballandra Bay, Carmen Island, May 22, 1921, 8 fathoms; three specimens; Fred Baker, coll.

18. **Sicyonia,** species

Ballandra Bay, Carmen Island, May 22, 1921, 8 fathoms; one female; Fred Baker, coll.

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[6] *Harriman Alaska Expedition,* Vol. 10, 1904, p. 34, fig. 12.

19. **Penæopsis,** species

Patos Island, anchorage, April 23, 1921; one female; Fred Baker, coll.

This and the preceding species were first taken by the *"Albatross"* and are being described in a forthcoming paper of the Albatross 1911 Expedition to Lower California.

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XXV[1]

EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA IN 1921[2]

OPISTHOBRANCHIATE MOLLUSCA

BY
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The number of Opisthobranchiate Mollusca collected by the Expedition is unfortunately small, but none the less interesting. The five specimens recorded in the following pages were all collected in the same locality, San Marcos Island, presumably between tide marks, though no data other than locality and date accompany the collector's label.

Family **Aglajidæ** Pilsbry, 1896

Pilsbry, H. A., 1896, Tryon's Manual of Conchology, XVI, p. 43. = *Doridiidæ,* Vayssière, Fischer, et al.

Body oblong, with two dorsal shields separated by a transverse furrow, the head shield having narrow, free, lateral and hind margins; posterior shield or mantle produced backward in two lobes, or wings. Foot wide, truncated in front and behind, the sides continuous into fleshy, parapodial (pleuro-

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[1] No. 37 of the Gulf Expedition papers.

[2] A map showing all the islands, etc., visited by this Expedition will be found in Vol. XII, No. 6, of these Proceedings, copies of which can be supplied for 50 cents.

November 29, 1924

podial) lobes, which stand erect or recurved at each side of the body. Shell internal, posterior, consisting of a flat, solute, spiral whorl and a minute spire, the inner rim of the whorl calcified, the outer part membranous. Ctenidium posterior, on right side, large, bipinnate. Buccal mass very large, without jaws or teeth. Penis with a superficial sulcus; prostate gland large.

The family at present contains but two genera, Aglaja Renier, and Navanax Pilsbry, the two being readily distinguishable by the presence of rhinophores at the anterior lateral angles of the cephalic shield in Navanax, while they are absent in Aglaja. Six species of Aglaja are recorded from the West American coast as follows:

1. *Aglaja maculata* (d'Orbigny); Valparaiso, Chile.
2. *Aglaja purpurea* (Bergh); Santa Catalina Island, California.
3. *Aglaja diomedea* (Bergh); Kodiak Island, Shurnagin Is., Alaska.
4. *Aglaja ocelligera* (Bergh); Sitka, Alaska.
5. *Aglaja adellæ* Dall; Eagle Harbor, Puget Sound, Washington.

To this list should also be added the allied genus Navanax with the species

6. *Navanax inermis* (Cooper); Santa Catalina Island, San Diego.
7. *Navanax ænigmaticus* (Bergh); Bay of Panama.

The present species is distinct from any hitherto described. Since it seemed desirable to preserve the single specimen as fully as possible, the following study is based almost entirely upon external characters, which are amply sufficient to establish its specific independence.

Genus **Aglaja** Renier, 1804

Aglaja Renier, 1804, Prospetto della Classe dei Vermi, p. 16, 1807, Tavole di Classificazione, Padova, tav. 8; 1847, Osservazioni postume di Zoologia Adriatica. Venezia. p. 3, tav. 16.

Doridium Meckel, 1909, Ueber ein neues Geschlecht der Gasteropoden. Beitr. vergl. Anat., Bd. I, H. 2, p. 14-33, taf. 6, fig. 12-21, taf. 7, fig. 1-8.

Acera Cuvier, 1810, Mém. sur les Acères. Ann. du Museum d'Hist. Naturelle, Paris, XVI, p. 9-12, 14-15, Pl. I, fig. 15-20.

Bullidium Leue, 1813, De Pleurobranchæa novo Molluscorum genere. Dissertation, Halle. p. 10, Nota.

Lobaria Blainville, 1825, Manuel de Malacol., p. 478.
Eidothea Risso, 1826, Hist. Nat. Europe Mérid., IV, p. 46.
Posterobranchæa d'Orbigny, 1837, Voy. dans l'Amérique Mérid., p. 201.
Melanochlamys Cheeseman, 1880, On a new Genus of Opisthobranchiate Mollusca, Trans. New Zealand Institute, XIII, p. 224.
Doridium Meckel, Vayssière, 1880, Recherches anatomiques sur les Mollusques de la Famille des Bullidés, Ann. des Sci. Nat., Zoologie, 6 Ser. IX, p. 73.
Doridium Meckel, Bergh, 1893, Die Gruppe der Doridiiden. Mitth. Zool. Station zu Neapel, XI, p. 109-111.

Head shield without rhinophores or frontal processes.

Aglaja bakeri MacFarland, new species

(Plate 11, figures 5-6; Plate 12, figures 12, 16-17)

General body color in the preserved specimen dark brown everywhere, marked with narrow, irregular, longitudinal lines of yellowish white on the cephalic and body shields and on the outer faces of the parapodia. The parapodia are edged with a narrow band of yellowish white, continuous behind across the posterior margin of the foot, but ceasing in front at their anterior ends. Near the parapodial margin on their outer face is a row of ocelli, composed of light blue, rounded or elliptical spots, each edged with a narrow band of black, the largest measuring circa 0.5 mm., in length. These submarginal ocelli, some 60 in all, are arranged at fairly regular intervals in a single series, extending the full length of the parapodial lobes, and across the posterior edge of the foot, but cease in front with the parapodia themselves. The external surface of the parapodia is of a slightly darker brown ground color than the dorsal areas, gradating below into a bluish black. Upon this background are borne some 17 to 20 narrow, longitudinal lines of yellowish white, occasionally interrupted, or broken into short dashes or dots. These lines are independent of each other in the main, but occasionally branch, or run together, widening out into elongated blotches. The inner surface of the parapodia is of an uniform light brown color, becoming darker below, though the unsatisfactory preservation of the inner faces makes details obscure. Posteriorly, in the gill-region, numerous very minute scattered ocelli may be made out with a lens, in each a central spot of brown being surrounded by a narrow halo of yellowish white.

The foot has a general ground color similar to the rest of the body, but deepening into a bluish black in its anterior half. It is everywhere thickly strewn with rounded, sharply defined, yellowish white spots, the largest ones arranged in a single, longitudinal, median row (Plate 11, figure 6). These may reach a length of 1.0 mm., the majority, however, not measuring more than 0.5 mm. in diameter. Other than the median series the distribution of these spots is irregular. Occasional double spots, caused by fusion, are not uncommon. The anterior margin of the foot is thick and fleshy, and slightly notched in the median line. The edge is squarish, darker in color, and bears a single series of rounded, closely set spots, similar to those of the general ventral surface.

The ground color of the cephalic shield is dark brown, deepening at the anterior thickened border to blue black; some 16-20 narrow, longitudinal lines of yellowish white, the number decreasing to about 12-14 behind, extend lengthwise of the shield (Plate 11, figure 5). But few of the lines are continuous throughout their whole extent, being more frequently interrupted or branched. Scattered dots and dashes also appear at intervals between the lines, and local widenings, affecting several adjacent lines, and occasionally causing slight fusions, give rise to local, lighter areas. At the posterior margin the lines widen, and merge into an indistinctly defined, light yellow zone, which also edges the sides of the shield. In front the thick, black edge of the shield bears an irregular series of closely set, yellowish white spots, similar to those of the anterior foot margin, immediately below.

The ground color of the posterior shield, or mantle, is light brown, relieved by narrow, longitudinal lines of yellowish white, similar to those of the cephalic shield, but wider. They are also broken into rows of dots, or interrupted at intervals, and are subject to local widenings. About midway of the length of the mantle a transverse zone of such local widenings gives rise to a light band, extending across the whole width of the mantle, as may be seen in figure 5 of Plate 11. Some 20 such lines may be counted toward the anterior margin of the mantle, the number increasing to over 35 in the posterior region. The posterior prolongations or lobes of the mantle are darker brown, the inner surface being dotted with light spots.

The sides of the body below the cephalic and somatic shields are light yellowish brown, deepening in front to nearly black. They bear numerous, elongated spots of yellowish white, all tending in a transverse direction. Similar transverse spots are continued in the groove between the shields, and behind the surface is everywhere flecked with smaller, white spots.

The general body form (Plate 11, figures 5 and 6) is elliptical in outline, plump and fleshy, strongly contracted by the killing agent, and now probably measuring not more than one-half the length in life. Length over all 14.5 mm., the greatest width 9.6 mm. and the greatest height 10.2 mm. The ventral foot area is rounded laterally, curving upward into the low parapodia with no sharply defined boundary (Plate 11, figure 6). The anterior margin of the foot is rounded at the angles, the strong contraction of the foot, immediately behind, causing them to project as rounded lobes, accented by the moderate notch in the median line. Immediately behind the anterior angles the sides of the foot are prolonged upward in the low, wing-like parapodia, which attain their maximum height of 5.7 mm. midway of the body length, thence narrowing to a low, thin expansion, 2.0 mm. in height, continuous across the posterior edge of the foot and uniting behind in the median line.

The cephalic shield, quadrangular in form, 10.0 mm. in length by 7.0 mm.in width, covers nearly one-third the length of the convex dorsal surface. Its anterior margin is thickened, in part due to contraction. The anterior, outer angles are prominently rounded and thickened, but do not show the peculiar short, inrolled tentacles, described by Bergh ('94) for *Navanax aenigmaticus* (Bergh) from Panama. The lateral and posterior margins are free, the latter overlapping the posterior shield, the former are concealed behind the edge of the parapodia.

The posterior body shield, or mantle proper, is of a general elliptical outline, set off from the rest of the body surface by a distinct margin with smooth outline (Pl. 11, figures 5 and 6). In front it is rounded and narrower, attaining its greatest width about midway of its length. Posteriorly it narrows into two thickened, triangular lobes, united by their bases above, but below separated by a circular opening, for which they form an incomplete boundary. This aperture forms the posterior opening of the pallial chamber, a roomy, triangular cavity beneath the right, posterior part of the mantle shield, and containing the branchial plume, the renal and anal openings. Its dorsal lining is deeply pigmented, the remainder is colorless or nearly so. The basal portion of the posterior lobes and the mantle immediately in front of them contain the spiral shell, the calcareous apex and central portion being prolonged upward and forward into the thin, membranous anterior part. In Plate 12, figure 12, the mantle lobes are reflected against the hinder surface of the dorsum to disclose the posterior opening of the pallial chamber, though in life they are directed backward. The right lobe appears to be a trifle larger than the left one, but no trace of a flagellum or similar prolongation of the left lobe is present, though it is a structure characteristic of many of the Aglajidæ. The total length of the mantle, exclusive of the two posterior lobes, is 16.0 mm., its maximum width is 12.0 mm., while the lobes themselves reach a length of 3.0 mm.

The ctenidium is a large, cresentic plume, lying in the anterior half of the pallial chamber. It consists of a flat, triangular, plate-like axis, continuous at its broad, proximal end with the ventral wall of the mantle cavity, to which it is attached in front and behind for ca. 3.5 mm., thence projecting as a free plume, curving around below the right, posterior mantle process. The dorsal and ventral surfaces of this plate bear triangular lamellae, which are in turn lamellate, thus forming a bipinnate gill, the most complex and highly developed of these lamellæ being found near the boundary of the attached portion, where they reach a height of 1.5 mm. Fifteen or sixteen of these branched lamellæ are found on the dorsal face of the plume, nearly as many occupying its ventral face. In the free portion the plume is so rotated that the dorsal lamellæ are directed forward in the specimen at hand (Pl. 12, fig. 12). The size of this figure precluded any attempt to show the detail of the branching of the lamellæ, and, furthermore, it is much clearer in that portion of the plume which is concealed beneath the mantle rather than in the exposed part. The anterior and posterior margins of the rhachis are occupied by the efferent and afferent vessels respectively. The whole plume is pale, yellowish white in color, with a few dark flecks scattered along the rhachis and the margins of the dorsal lamellæ.

Immediately behind the base of the plume and slightly to the right of the median plane is the anal opening. In front of it, and at a slightly higher level, is the minute, renal pore. Directly below the anterior attachment of the ctenidium to the body wall is the posterior genital opening, a vertical slit with a yellowish, posterior margin. From its lower end the clearly marked, spermatic furrow, a narrow groove with prominent margins, leads forward along the body wall, immediately above the origin of the right parapodium, to the penis opening at the extreme anterior, right side of the head. The furrow is edged throughout its entire length by a narrow line of black.

The shell (Pl. 12, figs. 16-17) consists of a posterior, narrow, calcified portion, expanded in front and at the left into a large, thin, membranous extension. The calcified part is made up of a minute spire, directed downward and backward, and a solute, falciform whorl, terminating near the right, posterior margin of the mantle in a blunt tip. The posterior, left portion of the whorl is flattened, the remainder is strongly convex. Upon the posterior surface of the spire a distinct crest is borne, which dies away as it continues forward. The hinder border of the whorl is strongly thickened as it becomes free from the spire, and thence thins away into an increasingly reflected margin toward the right. The anterior border of the calcified area (Pl. 12, figs. 16-17, *a*) is irregular, presenting a deep and narrow notch (possibly abnormal) near the left border of the shell, on the right side running parallel to the posterior border in general. In front it is continuous with the less convex, thin, transparent, membranous portion, widest on the left, and narrowing rapidly toward the right to less than half the width of the calcified portion, the tip of which it surrounds. Strongly marked lines of growth are evident throughout both areas of the shell. The general color of the calcified portion is a light yellow, deepening somewhat in the thicker portions. Its maximum transverse width is 4.7 mm., its maximum length is 4.4 mm., of which latter measurement the calcified portion comprises 1.6 mm., and the membranous portion 2.8 mm.

As usual in the genus the large pharyngeal bulb was destitute of both mandibles and radula.

Type: No. 1736, Mus. Calif. Acad. of Sci., collected May 12, 1921, at **San Marcos Island, Gulf of California,** by Dr. Fred Baker, to whom the species is dedicated in recognition of his untiring, scientific activity and interest.

Family **Aplysiidæ** Blainville, 1825

Animal lengthened, not protected by a shell, the neck and head narrower than the body; mouth a vertical fissure; anterior angles of the head produced into two, tentacular lobes folded above, behind them the cylindrical or conical rhinophores, slit above, in front of which are the minute eyes. Parapodia recurved over the back, forming two, lateral or dorsal lobes enclosing the mantle and ctenidium. Genital orifice between the dorsal lobes, communicating by a long furrow with the evertible penis, which is near the right tentacle. Shell nearly or entirely covered by the mantle, uncoiled, in the form of a concave plate, sometimes absent. Mouth with corneous jaws and a large, multiserial radula, composed of similar teeth; stomach armed with horny nodules; anus behind the branchial plume.

Genus **Tethys** Linnæus, 1758

Tethys Linnæus, 1758, Syst. Nat. Ed. 10, p. 655.
Laplysia Linnæus, 1767, Syst. Nat. Ed. 12, p. 1089.
Aplysia Gmelin, 1791, Syst. Nat. Ed. 13, I, VI, p. 3103.
Tethys, Pilsbry, 1895, Proc. Acad. Nat. Sci. Phila., p. 347; Pilsbry, 1896, Tryon's Man. Conch., XVI, p. 65.

Animal swollen behind, narrower in front, with rather long neck and head, bearing folded tentacles and slit rhinophores as usual in the family, the latter about midway between tentacles and parapodia. Parapodia arising in front of the middle of the animal's length, ample, freely mobile, free throughout their length, or united for a distance behind, functional as swimming lobes, anterior ends separated. Mantle nearly covering the ctenidium, having a median tube, foramen, or orifice communicating with the shell cavity, and produced behind in a more or less developed lobe or lobes, rolled to form an excurrent siphon. Genital orifice under front edge of mantle, in front of ctenidium; hypobranchial gland present, a short distance behind the genital opening. Foot well developed.

Shell very thin, membranous, with a thin, calcareous, inner layer, nearly as large as the mantle, concave, with pointed, small apex bearing a recurved lamina, and having a concave, posterior sinus.

The species of Tethys recorded from the Panamic Province are:

1. *Tethys panamensis* Pilsbry; Panama.
2. *Tethys robertsi* Pilsbry; West Coast of Mexico.

From the adjoining Peruvian Province five species are known:

1. *Tethys nigra* (d'Orbigny); San Lorenzo Island, Peru.
2. *Tethys rangiana* (d'Orbigny); Payta, Peru.
3. *Tethys lessoni* (Rang); Payta, Peru.
4. *Tethys inca* (d'Orbigny); Callao Bay, Peru.
5. *Tethys chierchiana* (Mazzarelli & Zuccardi); San Lorenzo Island, Peru.

The Californian forms at present listed are:

1. *Tethys californica* (Cooper); Monterey to San Pedro.
2. *Tethys ritteri* Cockerell; San Diego.

To the Panamic forms is to be added the Antillean species studied in the following pages, having been taken by the expedition at San Marcos Island. Without doubt further collecting in the region will bring to light other species than those listed.

Tethys parvula (Guilding ms. Mörch)

(Plate 11, Figures 1-4; Plate 12, Figures 1-11)

Aplysia parvula Guilding ms., Mörch, 1863, Contributions à la Faune malacologique des Antilles danoises. Journal de Conchyliologie, Sér. 3, III, p. 22-23.

Tethys parvula (Guilding) Mörch, Pilsbry, 1896, Tryon's Manual of Conchology, XVI, p. 83-84, Pl. 37, f. 23-25.

Tethys parvula (Guilding) Mörch, Dall & Simpson, 1902, Mollusca of Porto Rico, Bull. U. S. Fish Comm., XX, Part I, p. 366, Pl. 53, f. 14.

Tethys parvula, the smallest species of the genus, has thus far been recorded only from St. Thomas, St. Vincent, and the Caballo Blanco Reef off Vieques Island, all in the Lesser Antilles. To find it nearly 50 degrees to the westward in the Pacific Ocean, without any record of intermediate occurrence is somewhat surprising, but illustrates again the paucity of our knowledge concerning the distribution of the Opisthobranchs. Without doubt it is of wide occurence in the Carribean Province, and is here added to the Panamic fauna as well by the Academy Expedition. Some 52 living Molluscan species have been verified by Mrs. Ida S. Oldroyd as either living at present in both these Provinces, or as having formerly so existed. These are survivals of the forms which, probably in the Oligocene, were able to pass through the open sea connecting the Atlantic and the Pacific oceans in this region. As yet uncertainty exists concerning any later connection between the two oceans. "As far as now known the Miocene was a period of elevation all through this region, and no strictly Miocene marine strata have as yet been identified." (Prof. W. H. Dall in letter to Mrs. Ida S. Oldroyd). The view held by Vaughan ('17), based upon a study of the reef corals of the upper Gulf of California, would indicate an interoceanic connection scarcely later than the lower Pliocene, but his evidence seems insufficient to Dickerson ('17) among others, who places the latest connection as in Miocene time. In the absence of recorded fossils of any of the Aplysiidæ, the distribution of this present species is at present the only evidence we have of the age of the group.

The three specimens (Pl. 11, fig. 1-4) are all strongly contracted in the head and tail regions, and the epidermis everywhere is softened and more or less detached, so that details of the coloration are but poorly preserved, though the characteristic features of the species are unmistable. The body form is somewhat prismatic, slightly higher than wide, soft, the anterior tentacles are strongly contracted, the wide, short head bears two, moderate, inrolled rhinophores, their bases close together, separated by a distance of from 1.0 to 1.2 mm. The eyes are faintly visible through the integument in front of the bases of the rhinophores, and are slightly nearer to them than to the anterior tentacles. The parapodial lobes are large and fleshy, their anterior ends widely separate and auriculate, projecting forward as a free, rounded lobe above the point of union with the body (Plate 11, fig. 1). Behind the parapodia are continuous, closely enclosing the relatively large shell, which is conspicuous through the very large, thin-edged mantle foramen, 2.8 mm. long by 2.4 mm. wide. The mantle margin projects slightly in front and on the left side, while on the right it overlies the deep branchial chamber.

The ground color of the animal is light brown, clouded and mottled irregularly with darker shades; the sides of the parapodia, the top and sides of the head and tail are thickly set with small, rounded spots of light yellow, or, rather, these spots are destitute of pigment and the translucent yellow of the underlying tissues shows through. The margin of the mantle foramen, the margin of the parapodia, the anterior margin of the foot, the anterior margin of the head and the anterior tentacles are all bordered with a narrow zone of intense black. This black marking is identical with that found by Dall and Simpson ('02).

The foot is so strongly contracted that its details are obscure. The tail region is short and broad, and the anterior margin shows a distinct, median notch.

The shell (Pl. 12, figs. 7-10) is very large in proportion, but does not cover the whole animal, as stated by Dall and Simpson. It is strongly convex, rather thick, calcareous, oval in general outline, narrowing behind. Its margin is uncalcified, thin and membranous, broadest in front and along the left, anterior side, decreasing at the sinus region, and continuing over the apex as a scarcely discernible, narrow band (Pl. 12, figs. 7-10). The concentric lines of growth are very distinct, forming between them slight ridges, readily visible when seen in profile in favorable illumination and magnification (Pl. 12, fig. 7). The apex is strongly incurved, involute and thickened, with the reflexed margin prolonged as a narrow band over the tip (Pl. 12, fig. 9). The posterior sinus on the right is strongly concave, as seen in side view (Pl. 12, fig. 7). The color of the shell is pale amber to reddish and the inner surface is slightly iridescent. In the animal measuring 9.2 mm. in total length the shell dimensions were as follows: length 5.0 mm., width 3.4 mm., height 1.7 mm., length of sinus 1.6 mm. These measurements agree closely in proportions with those given by Pilsbry ('96), and by Dall and Simpson ('02), though their specimens were considerably larger. The oval mantle foramen, through which the shell is visible, is very large in this species, disclosing over one-third the area of the shell. *T. rangiana* (d'Orbigny) from Peru also possesses this characteristic, but is otherwise distinct.

The ctenidium lies transversely in the pallial chamber, below the anterior half of the shell and mantle. It is of somewhat triangular form, attached by its anterior and posterior margins, the tip projecting below the mantle to the right.

The right posterior margin of the mantle is inrolled and continued above the sinus of the shell, forming a very short and rather wide siphon, leading outward from the pallial chamber. Into it on the left side opens the anal tube, and below and in front of the latter is the inconspicuous, renal opening. At the anterior end of the pallial chamber, opposite the end of the right parapodium is the posterior genital opening. From it the narrow, spermatic furrow leads downward and forward, below the right rhinophore to the external opening of the penis sheath, below the right tentacle at the side of the head. Immediately behind the posterior, reproductive opening is an area, some 2.2 mm. long, through which open the cells forming the hypobranchial, or opaline gland, the so-called Organ of Bohadsch. The organ as seen from within (Pl. 12, fig. 11) is made up of a group of closely set, gigantic, unicellular glands with dilated, ends, projecting freely from the integument. The most of these are of the diffuse type, each cell opening independently through the integument, but at the anterior end of the group is a cluster of cells (Plate 12, fig. 11*a*), which seem to open into a common duct. A detailed study of this structure with serial sections of properly fixed material would prove valuable, since this species seems to unite two distinct types of opaline gland structure, the diffuse and the compact, hitherto found separately in widely different species.

The chief measurements of the three specimens at hand may be tabulated as follows:

Specimen No.	1	2	3
Length over all	7.8 mm.	9.1 mm.	9.2 mm.
Maximum width	4.5 "	3.9 "	4.6 "
Maximum height	4.7 "	5.1 "	4.0 "
Length of parapodia	4.8 "	5.0 "	5.3 "
Length in front of parapodia	——	2.7 "	2.3 "
Width between anterior ends of parapodia	2.8 "	2.1 "	3.4 "
Width between rhinophores	1.0 "	1.2 "	1.0 "
Length of shell foramen	3.0 "	3.6 "	3.2 "
Width of shell foramen	2.7 "	3.0 "	2.0 "

The pharyngeal bulb has the form of a truncated, four-sided pyramid. It is 2.2 mm. long by 1.9 mm. in maximum width and height, tapering to 1.2 mm. at the anterior end. It is continued in front to the mouth opening by a short, thick walled, oral tube. At the median, posterior surface the rounded end of the radula sack is visible, but it does not project beyond the general surface of the bulb. The opening from the oral tube into the bulb is a vertical slit, 0.6 mm. long, in the center of an oval, cuticular disk, pigmented with dark brown at the margins and becoming lighter yellow within. The sides of the opening are guarded by the large, mandibular rodlet areas or plates. These (Pl. 12, fig. 6) nearly meet in the median line above and below, are somewhat triangular in form, broadest (0.7 mm.) above, the anterior margin 0.9 mm. long and slightly curved, the posterior one deeply so, the width at the ventral side decreasing to one half that of the dorsal border of the armature. Each mandibular plate is made up densely packed cylindrical rodlets, longest at the anterior margin and decreasing progressively in length posteriorly. The individual rodlets (Pl. 12, figs. 4 and 5) are slightly curved or nearly straight elements, the tips being directed slightly forward. Each of the rodlets is the cuticular product of a single epithelial cell (MacFarland '18). The greatest length attained by these rodlets is 0.041 mm., their width averaging 0.0055 mm.

The light amber radula is broad, and moderately grooved in the median line. It occupies the posterior face of the muscular rotula, curving forward upon its upper surface, while below its sides converge into the somewhat cylindrical, short radula sack. At its anterior end the radula narrows abruptly to the width of the median groove alone, the oldest row of teeth being represented by the single rhachidian one. The total length of the radula is 2.1 mm., its maximum width 1.6 mm. The teeth are arranged in twenty-six rows, of which twelve are functional at the anterior end, and fourteen are inclosed in the sheath, the last one being rudimentary. Each row is made up of a single, median tooth and ten to twelve laterals on each side, the outermost two or three of which become reduced to flattened plates, the dental formula hence being expressed as 26 (10-12 . 1 .10-12). The number thus indicated is the smallest yet recorded for any Tethys, and rather appropriately is found in the smallest species of the genus. The median tooth and a complete half-row are shown in figure 1 of Pl. 12, and the same elements are represented in basal view in figures 2 and 3 of the same Plate.

The median tooth (Pl. 12, fig. 1, *c*) is broad and strong, its base (fig. 2) a trapezium in form, its posterior, outer angles produced in wide spreading, rounded prolongations. The median cusp is broad and strong and bears on either margin a series of six to seven denticulations, the largest nearest the base, the remainder decreasing progressively in size toward the tip of the cusp, the outermost being reduced to mere serrulations in many teeth. Lateral to the median cusp on either side is borne another cusp of similar form, but of half its length. The margins of this first lateral cusp are either minutely serrulate or entirely smooth, the outer margin frequently showing a narrow, shelf-like lamina along its lower border. A second, lateral cusp of similar form, but of approximately one-half the size of the first lateral succeeds it outwardly, and indications of a third, minute, rudimentary, external cusp may also be found in some rhachidian teeth. The dimensions of these structures as found in two typical rows, the 11th and the 22d, may be tabulated as follows:

	Eleventh row		Twenty-second row	
	Length	Width	Length	Width
Median cusp	0.033 mm.	0.042 mm.	0.042 mm.	0.042 mm.
1st. lateral cusp.......	0.015 "	0.018 "	0.021 "	0.024 "
2d. " "	0.008 "	0.012 "	0.012 "	0.010 "
Base of tooth........	0.090 "	0.216 "	0.096 "	0.198 "

The lateral teeth are arranged in an oblique series with reference to the rhachis of the radula. The contours of the bases of the lateral teeth shown in figure 1 of Pl. 12 are drawn in fig. 3 of the same Plate. The first of the row (*1*) is broad in front, obliquely triangular, with all the angles rounded, the others narrow and decrease in size progressively, the triangular form being soon replaced by an elongate one. From the anterior end of the first lateral (Plate 12, fig. 1-*1*) a strong hook arises, bearing a large, denticulate, median cusp, a single, smaller, smooth margined, inner cusp, and a series of three, outer ones decreasing in size, all having smooth margins. A comparison with the median tooth shows a striking similarity, the latter apparently being made up from the fusion of two, symmetrical laterals in the median plane, the inner cusp of the laterals being lost in the process. The successive laterals beyond the first present the same general form, decreasing in size and complexity, and finally in the outer three becoming reduced to oblong, slightly thickened plates, destitute of a hook, or with but a faint rudiment of such at the anterior end. A comparison of the different teeth shown in fig. 1 of Plate 12 will render these and other details more evident than through a long description.

Three specimens of this species were collected at San Marcos Island, Gulf of California, by Dr. Fred Baker, on May 12, 1921. One of these was dissected in making the foregoing study, and the preparations made from it, together with the other two, are deposited in the collections of the California Academy of Sciences.

Family **Elysiidæ** Gray, 1857

Body form flattened, with lateral, leaf-like expansions, separated from the dorsum by a distinct, elevated line. Head narrow, rather high in front; tentacles short, auriform, involute. Genital openings behind the right tentacle. Behind the head the large, reno-pericardial prominence, with the anal opening at its right side, or posterior in the median line.

Foot obscurely set off from the body, in front transversely divided into two parts, its anterior angles slightly prominent.

Pharyngeal bulb suctorial, but without prominent ingluvies. Radula uniserial, the teeth large, compressed, dagger-like, usually serrulate or finely denticulate below.

Hermaphroditic and accessory reproductive glands greatly ramified throughout the lateral processes of the body. Penis unarmed.

Genus **Tridachia** Deshayes, 1857

Tridachia Deshayes, 1857, Journal de Conchyliologie, II Sér. II, p. 141.
Pterogasteron Pease, 1860, Proc. Zool. Soc. London, XXVIII, p. 35.

The genus Tridachia Deshayes is closely related to Elysia Risso, but differs in the extraordinary development of the parapodia, which possess very long and undulating margins ("profondement contournées à la manière des feuilles de laitue," Deshayes), from which fancied resemblance to a lettuce leaf the generic name arises. The anterior ends of the parapodia are also united to each other behind the head and in front of the reno-pericardial elevation. Posteriorly the narrowing parapodia are continued to the tip of the tail, where they fuse. The sack at the anterior end of the radula, inclosing the discarded teeth, is but little developed. To this genus belong the genotype *Tridachia schrammi* Deshayes, and *Tridachia crispata* (Oersted, Mörch), both from the Antilles.

In the collections made by the "Albatross" in 1891 in the Gulf of California Bergh ('94) found two specimens, which he doubtfully described as *Tridachia ? diomedea* Bergh, owing to the fact that the parapodia did not unite in front as in the genus *Tridachia.* The Academy expedition of 1921 brought back a specimen from San Marcos Island, which is clearly the same as the form described by Bergh. It is equally evident that the parapodia do not unite in front behind the head, so that it cannot belong to the genus *Tridachia* as originally constituted. Bergh's ('72) earlier studies of *Tridachia crispata* (Oersted, Mörch), based upon the original specimens of Mörch, together with other specimens from the Antilles, leave no doubt as to the validity of the character for that genus. The only alternative then is to erect a new genus for the Gulf of California form, which is here proposed.

Tridachiella MacFarland, new genus

Head rounded above, with large inrolled tentacles; anus anterior latero-dorsal. Lateral expansions of the body wide, their margins greatly plicated and sinuous, the anterior ends approaching each other dorsally, in front of the reno-pericardial elevation, but not uniting.

November 29, 1924

Tridachiella diomedea (Bergh)

(Plate 10, Figures 1-3; Plate 12, Figures 13-15, 18-21)

Tridachia ? diomedea Bergh, 1894, Die Opisthobranchien, Bull. Mus. Comp. Zool. Harvard, XXV, 10, p. 194-5, Taf. I, f. 1-7.

The animal, preserved in formalin, seemed but slightly contracted, save possibly in the rhinophore region. The body length over all, from the anterior margin of the head to the tip of the tail, measured 35.4 mm. The greatest width, with the parapodia in their reflected position as preserved, is 14.3 mm., of which measurement 8.3 mm. forms the body proper. With the parapodia carefully flattened out horizontally the maximum width was 20.3 mm., the actual dimensions of the living animal probably exceeding these considerably.

The general body form, strikingly similar at first glance to a polyclad worm, is well shown in figures 1, 2 and 3 of Plate 10. The head is well developed, extending 4.0 mm. in front of the anterior margins of the parapodia. The rhinophores are relatively very large, 3.2 mm. in length by 2.0 mm. in anteroposterior and 1.8 mm. in transverse, maximum diameter. These dimensions are of course somewhat less than in the living animal, and are subject to variations, since the rhinophore consists of an inrolled, flattened plate (Pl. 12, fig. 21) the anterior margin slightly overlapping on the outer face.

The ground color of the preserved specimen is everywhere pale yellow to translucent grey. The margins of the parapodia bear a single row of velvety black, triangular or rounded spots, borne alternately on the outer and inner surfaces, slightly below the edge. Toward the tip of the tail these spots become closer together and finally coalesce into a black band, some 2.0 mm. in length, parallel to and bordering the inner and outer margin of each parapodium, and uniting at the tip of the tail. Traces of orange yellow are recognizable along the outer border of the parapodia in the edging of the most anterior lobe, which is directed transversely across the back toward its fellow of the opposite side. Minute flecks of black are also scattered sparsely over the dorsum and both surfaces of the parapodia.

The inner surface of each rhinophore is almost entirely black, and the outer surface is irregularly banded transversely with the same color.

The foot (Pl. 10, fig. 3) is fairly well set off from the sides of the body, which rise above it, by a faint groove. It is divided into a shorter, anterior portion, 6.0 mm. in length, and a longer portion by a shallow, transverse groove. Its total length reaches 33.7 mm., its anterior end is dilated to 5.3 mm., thence narrowing rapidly to 3.0 mm. at the junction of the anterior and posterior areas, widening gradually again to 3.7 mm., midway of the body length, from which point it narrows slightly to the short, blunt tail. The anterior angles are bluntly rounded and prominent, with a wide notch in the median line of the foot separating them.

The parapodia extend the full length of the body from the neck region to the tip of the tail. They are thrown into six, main folds, the free margin being much longer than the basal line of insertion in the side of the body. These folds are in turn convoluted into a great number of smaller folds, the whole presenting the appearance of an elaborate ruffle (Pl. 10, figs. 1 and 2). The anterior ends of the parapodia curve inward toward the median line (Pl. 12, fig. 20), but do not meet, each terminating in a small lobe and leaving a narrow, mid-dorsal space free, 1.0 mm. in width. The anterior termination of the parapodia is 2.0 mm. behind the base of the rhinophores.

The mouth opening is small, oval in outline (Pl. 10, fig. 3) and is situated at the lower end of a median furrow, which is prolonged upward between the bases of the rhinophores as a shallow depression. A transverse furrow separates the mouth region from the anterior end of the foot.

The eyes (Pl. 12, figs. 20 and 21) are conspicuous small black bodies, 2.5 mm. apart, immediately behind the bases of the rhinophores, below the integument.

The reno-pericardial elevation (Pl. 12, fig. 20) forms a prominent, oval area in the anterior, mid-dorsal region, immediately behind the anterior ends of the parapodia. Behind it the mid-dorsum becomes concave, extending thus to the tip of the tail. The reno-pericardial prominence is 3.5 mm. long by 2.0 mm. wide, and from its posterior end on either side an elevated ridge marks the course of a vessel, passing backward and outward along the base of the parapodium, to which it sends off branches at intervals. From the anterior, left side of the elevation a similar ridge arises, at once dividing into two divergent branches, which pass to the anterior portion of the left parapodium. On the right side a similar branch appears, subdividing a little farther from its origin, and having a like distribution. These ridges presumably contain ramifications of the liver tubules.

Immediately in front of the right, anterior ridge just described, and slightly toward the median line is the anal opening, Pl. 12, fig. 20, *a*. Slightly behind the middle of the reno-pericardial prominence, on its right side, is located the inconspicuous renal opening, *r*. Just in front of the anterior end of the right parapodium as it curves inward is the opening of the oviduct, Pl. 12, fig. 21, and slightly above and behind it is an obscure opening, which I identify as the vaginal aperture, though certainty could not be attained save by complete dissection, or, better, by serial sections, and it was not desirable under the circumstances to injure the specimen more than absolutely necessary. At the outer base of the right rhinophore is situated the external opening of the penis, concealed in fig. 21 of Pl. 12 by the upturned, and slightly swollen margin of the foot. In Bergh's ('72) account of *Tridachia crispata* he figures in Pl. XXI, f. 14, *a, b,* the opening of the oviduct as situated in front of the base of the rhinophore and the penis sack opening, while his description locates it behind the latter. He apparently did not find the vaginal opening at all, its recognition in Elysia being due to Pelseneer ('94) much later.

The ellipsoidal, pharyngeal bulb is surprisingly small for such a large animal, measuring not more than 1.4 mm. in length by 1.0 mm. in height. Its short mouth tube is surrounded by a thick, cushion-like mass of oral glands. The posterior salivary glands form a closely branched, alveolar mass on either side of the oesophagus, extending backward between it and the retractor muscles of the bulb to the stomach region. Their ducts pass through the nerve collar and each dilates into a small, spherical ampulla, just before entering the posterior wall of the pharyngeal bulb, close to the emergence of the oesophagus. The upper half of the bulb is strongly muscular, 18-20 transverse bands of muscle being conspicuous upon its dorsal surface. Its cavity, however, is relatively simple and there is no indication of an even partially separated, dorsal ingluvies, or suctorial cavity. No trace of a differentiation of any mandibular apparatus is present within the opening of the mouth tube into the bulb. The cavity of the whole bulb is lined by a well developed cuticle, which is reflected around the mouth margin and thins away in the oral tube, while behind it is prolonged into the oesophagus. From the ventro-median surface this cuticle is prolonged downward as a cylindrical sack, clothing the radula sheath, and in the anterior wall of this sack the radula itself is differentiated as a cuticular modification. The anterior end of the radula is prolonged downward as a similar tubular, cuticular evagination, the lower end of which dilates into the characteristic ascus of the Ascoglossa, in which the cast-off teeth from the anterior end of the radula are preserved, instead of being shed free in the cavity of the pharyngeal bulb.

The radula is narrow, small and compressed, making a sharp angle in the anterior portion of the bulb, its ends not making any projection beyond the lower surface of the organ. Pl. 12, fig. 13, illustrates the three teeth nearest the angle in the front limb and the upper one at the top of the sheath in the posterior limb. Evidently but few of the teeth are functional at the same time, the one at the angle and those immediately in front of it being probably all that are in use. At the bottom of the anterior limb in the ascus are three, loose, discarded teeth, another, just freed from its attachment, is at the entrance to the sack, the anterior limb of the radula contains eight still attached by their bases, and the posterior limb, or radula sack, in which the teeth are formed, ten more, making twenty-two in all. Fig. 14 of Pl. 12 represents the third, discarded tooth as seen obliquely from below. All the teeth are of practically the same size throughout the radula, each measuring 0.195 mm. in total length, of which 0.105 to 0.112 mm. make up the length of the spine. The height of the top of the tooth above the base is 0.075 mm., and the length of the base itself varies from 0.8 to 0.10 mm. The base is moderately thick and wide, its ventral surface is concave, and the ends are rounded. Upon it is borne a strong spine or hook, nearly straight, the tip being slightly curved downward. Seen from above this spine is somewhat broad and shaped like a two-edged dagger. No denticulations were found upon its lower surface. Upon the dorsal surface of each tooth is a wide depression, into which the spine of the succeeding tooth fits exactly, as seen in outline in fig. 15 of Pl. 12, which is represented as if transparent. The lateral walls of this depression flare out at the posterior ends in short, wing-like processes, seen in side view in figure 15 and in oblique view from the rear in figure 14.

The central nervous system (Pl. 12, figs. 18 and 19) is made up of the paired, fused cerebro-pleural, the pedal, parietal and buccal ganglia and the large unpaired visceral ganglion, closely united in a group surrounding the oesophagus, in contact with the posterior face of the pharyngeal bulb. The optic nerves are very long as indicated in the figure. To identify and trace out the distribution of the nerves in an adequate manner was impossible, without completely destroying the specimen, so no further dissection was attempted.

One specimen, collected by Dr. Fred Baker at San Marcos Island, Gulf of California, May 12, 1921, preserved in the Museum of the California Academy of Sciences.

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EXPLANATION OF PLATES

The figures of Plates 10 and 11 are reproduced from photographs of the specimens; those of Plate 12 are from drawings made by Mrs. Olive H. MacFarland, from preliminary camera lucida sketches by the author.

Plate 10

Figs. 1-3. *Tridachiella diomedea* (Bergh).

Fig. 1. Oblique view of the animal as seen from the right and above. X 2.

Fig. 2. Dorsal view. At the right the non-union of the parapodial ends behind the head is evident. See also Plate 12, figure 20. X 2.

Fig. 3. Ventral surface as seen slightly obliquely from the right. X 2.

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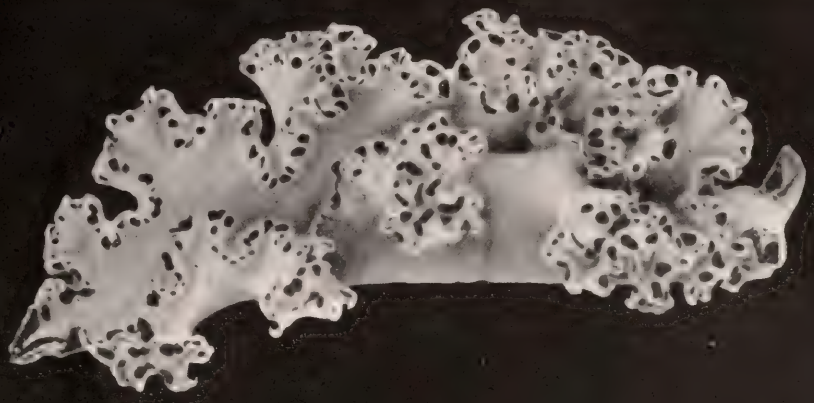

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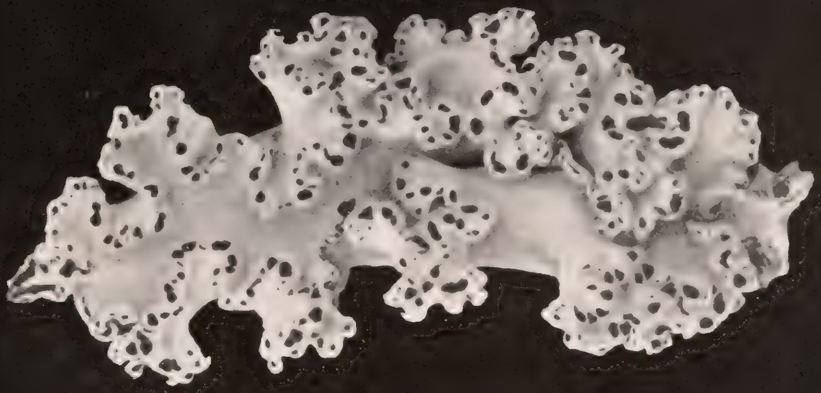

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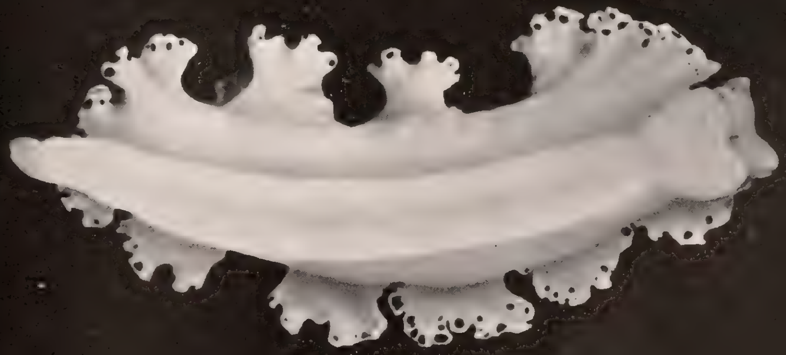


Plate 11

Figs. 1-4. *Tethys parvula* (Guilding, Mörch).

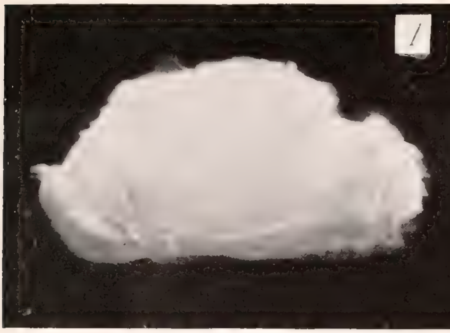
Figs. 5-6. *Aglaja bakeri* MacF. New Species.

Figs. 1 and 2. Side views from the right of two different specimens. The macerated epithelium has caused considerable haziness in the outlines. X 6.

Figs. 3 and 4. Dorsal views of the same specimens. X 6.

Fig. 5. Dorsal view, the tips of the parapodia being reflected outward somewhat. The head shield, toward the top of the figure, is seen quite obliquely, the broad, posterior one much less so. X 5.

Fig. 6. View of the animal as seen obliquely from the right and below. The rounded foot surface is on the right, its anterior end toward the top of the figure. X 5.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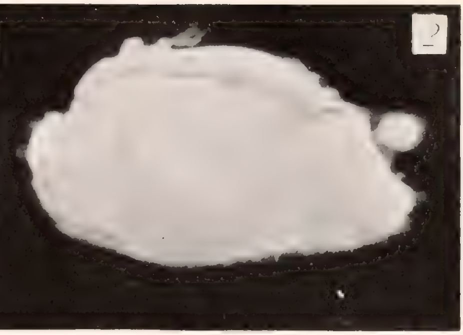
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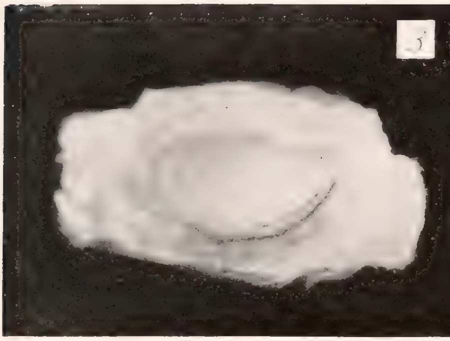
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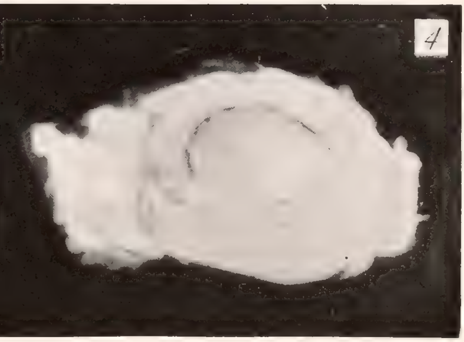
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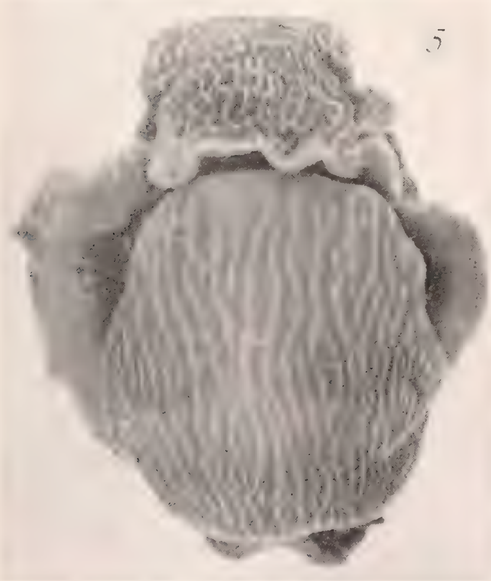
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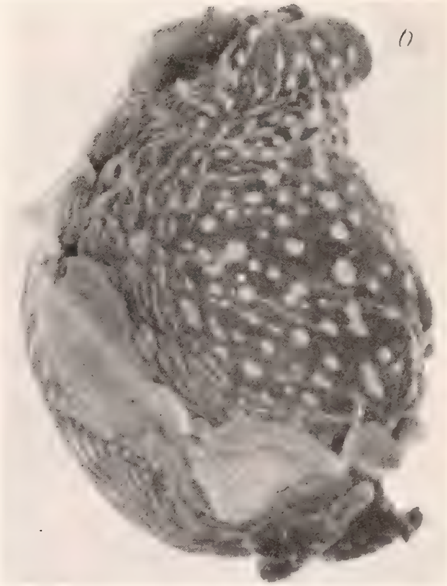
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Plate 12

Figures 1-11. *Tethys parvula* (Guilding, Mörch).

Fig. 1. Half of eleventh row of the radula as seen from above. *c*, median tooth; *1*, first lateral tooth. X 135.

Fig. 2. Base of the median tooth shown in the preceding figure, seen from below. X 135.

Fig. 3. Bases of the half row of lateral teeth shown in Fig. 1, as seen from below. *1*, first lateral tooth. X 135.

Fig. 4. Three individual rodlets from the upper, anterior margin of the labial armature. X 351.

Fig. 5. Rodlets from the anterior border toward the lower margin of the labial armature. X 351.

Fig. 6. Surface view of whole, labial armature. *a*, anterior margin. X 17.

Fig. 7. Shell as seen in profile view from the right side. X 7.

Fig. 8. Shell as seen in ventral view. X 7.

Fig. 9. Detail of apex of the shell as seen in ventral view. X 17.

Fig. 10. Shell as seen in dorsal view. X 7.

Fig. 11. Hypobranchial or opaline gland (Organ of Bohadsch) as seen from within. The cells of the lobe *a* open through a common duct to the exterior; those of the upper, remaining portion have individual, independent openings. X 17.

Fig. 12. *Aglaja bakeri* MacF., as seen from behind. The parapodia have been deflected downward and outward, and the tips of the posterior mantle lobes are folded outward against the surface of the body, revealing the posterior opening to the pallial chamber. On the right the outer half of the ctenidium is exposed from beneath the mantle. X 4.

Figures 13-15 *Tridachiella diomedea* (Bergh).

Fig. 13. Lateral view of the teeth at the summit of the radula angle. The tooth directed downward at the left, the twelfth of the series, is just emerging from the radula sheath. X 45.

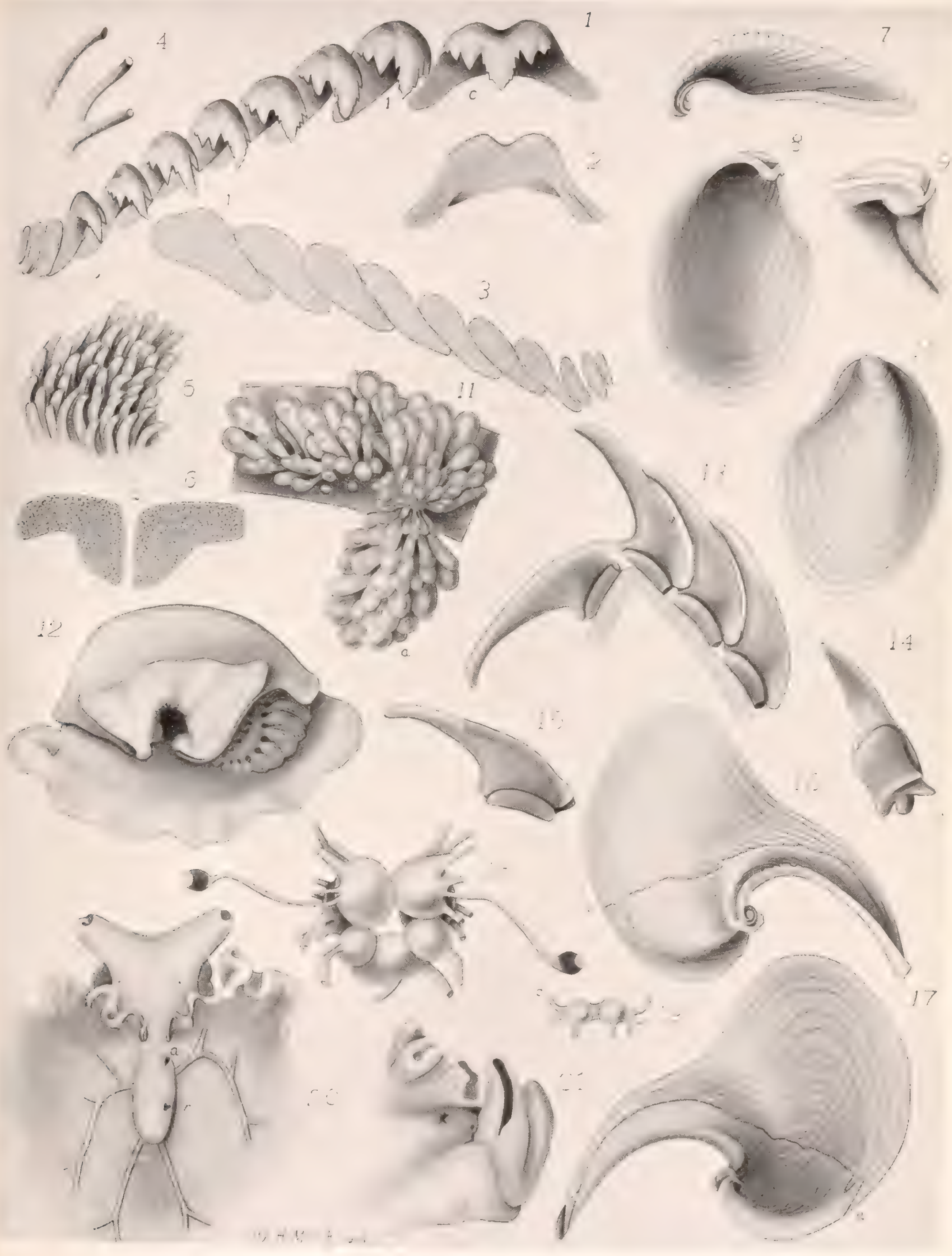
Fig. 14. Second tooth of radula, discarded and inclosed in the ascus at the anterior end of the radula, as seen obliquely from below. X 45.

Fig. 15. Fourth tooth of the radula in side view, showing the depression on its dorsal surface into which the hook of the preceding tooth fits. X 45.

Fig. 16. Shell of *Aglaja bakeri* MacF. in dorsal view. The irregular line *a* indicates the boundary of the calcified portion behind and the membranous area in front. The transparency of the membraneous area has been lost in the reproduction. X 8.8.

Fig. 17. Shell of *Aglaja bakeri* MacF. in ventral view, the line *a* marks the boundary of the calcified area as in the preceding figure. X 8.8.

[Continued on Page 420]


c
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a
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Plate 12—Continued

Figures 18-21, *Tridachiella diomedea* (Bergh).

Fig. 18. Central nervous system in dorsal view. The large, cerebro-pleural ganglion pair is shown above, immediately behind and in contact with them lie the smaller, parietal ganglia, below and behind the parietal pair is the very large, unpaired visceral ganglion, while the paired pedal ganglia are nearly concealed by the cerebro-pleural ones. The optic nerves are especially long, and terminate in the black eyes, in the figure displaced considerably from their normal positions. X 23.

Fig. 19. The buccal ganglia in dorsal view, removed from their normal position below the cerebro-pleural ganglia, the cerebro-buccal connectives, *c*, curving forward and upward to unite with the cerebral ganglia. X 23.

Fig. 20. Dorsal view of the anterior end of the animal, the parapodia being pressed apart to show their anterior terminations on the body wall, in front of the elliptical, reno-pericardial eminence, from beneath which elevated ridges proceed, inclosing the main branches of the liver to the lateral body expansions. *a*, anal opening, *r*, renal opening. X 3.5.

Fig. 21. View of head of animal from the right side, showing the involute, right rhinophore, the eye immediately behind its base, and, further back, the opening of the oviduct, just in front of the anterior, incurving fold of the parapodium. X 3.5.

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XXVI

NOTES ON WEST AMERICAN WHALE BARNACLES

BY

IRA E. CORNWALL

The two whale barnacles, *Coronula diadema,* and *Conchoderma auritum,* have been described by Darwin in his monograph of the Cirripedia, and the shell of *C. diadema* has been described by Dr. H. A. Pilsbry[1], but in neither of these descriptions are the mouth parts and cirri fully figured. This is probably because both species can be recognized by outward form alone. As the whales, and consequently the whale barnacles, are becoming scarcer each year, it seems advisable to describe, and figure these barnacles while they can be obtained. Also, upon examination of specimens it was found that they differed slightly from Darwin's descriptions. The specimens described herein were collected by Captain J. E. Gilmore, of Cachalot, British Columbia, and have been deposited in the Museum of the California Academy of Sciences[2].

Coronula diadema (Linnæus)

(Plate 13; figures 2-4; text figure 1)

1767. *Lepas diadema* Linnæus, Systema Naturæ, ed. 12, p. 1109 (see Hanley, The Shells of Linnæus, p. 20).

1776. *Lepas balænaris* O. F. Müller, Zoolohiæ Danica Prodromus, p. 250, No. 3024.

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[1] U. S. National Museum Bulletin No. 93.

[2] *Conchoderma auritum,* (pl. 13, fig. 1) is No. 1734 and *Coronula diadema,* (pl. 13, figs. 2-4) is No. 1735 of the collection of type material of the Department of Paleontology.

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1778. *Balanus balæna* Da Costa, Hist. Nat. Test. Brit., p. 251.
1780. *Lepas balænaris* O. Fabricius, Fauna Grœnlandica, p. 425.
1789. *Balanus diadema* Bruguière, Encyclop. Method., Pl. 164, fig. 13, 14.
1790. *Lepas balænaris* Gmelin, Systema Naturæ, ed. 13, p. 3208.
—— *Lepas diadema* Chemnitz, Conch., vol. 8, Tab. 99, figs. 843, 844.
1817. *Diadema vulgaris* Schumacher, Essai d'un nouveau Syst. Vers Testaces, p. 91.
1818. *Diadema candidum* Ranzani, Opuscoli Scientifici, vol. 2, p. 88.
1818. *Coronula diadema* Linnæus, Lamarck, Hist. Nat. Anim. sans Vert., vol. 5, p. 387.
1824. *Coronula diadema* De Blainville, Dict. des Sc. Nat. Tab. 117, fig. 4.
1824. *Coronula diadema* Leach, Encyclop. Brit. Suppl., Vol. iii.
—— *Coronula diadema* Chenu, Illst. Conch., Plate, fig. 3.
1825. *Polylepas (Diadema) kleinii* Gray, Annals of Philosophy, new ser., vol. 10, p. 105.
1834. *Coronula diadema* Burmeister, Beiträge zur Naturgeschichte der Rankenfüsser, Tab. 2, fig. 1-14, 18.
1854. *Coronula diadema* Linnæus, Darwin, Monograph on the Sub-Class Cirripedia, p. 417, pl. 15, figs. 3, 3a, b; pl. 2, fig. 3; pl. 3, fig. 5.
1870. *Coronula biscayensis* Van Beneden, Bull. de l'Acad. Roy. des Sci. des Lettres, et des Beaux-Arts de Belgique, ser. 2, vol. 29, p. 349. No description.
1870. ?*Diadema japonica* Van Beneden, Bull. de l'Acad. Roy. des Sci. des Lettres, et des Beaux-Arts de Belgique, ser. 2, vol. 29, p. 354. Also *Diadema californica*, p. 355.
1874. *Coronula diadema* Linnæus, Scammon, The Marine Mammals of the Northwest Coast of North America, p. 47, pl. 10, fig. 5.
1897. *Coronula diadema* Linnæus, Weltner, Verzeichnis, Archiv fur Naturgeschichte, vol. 1, p. 254 (distribution).
1900. *Coronula diadema* Linnæus, Weltner, Fauna Arctica, vol. 1, p. 302 (distribution).
1903. *Coronula diadema* Linnæus, Stead, Proc. Linn. Soc. New South Wales, vol. 28, p. 944.
1905. *Coronula diadema* Linnæus, Gruvel, Monographie des Cirrhipedes ou Thecostraces, p. 273, text fig. 298, CC.
1916. *Coronula diadema* Linnæus, Pilsbry, U. S. Nat. Mus. Bulletin 93, pl. 65, figs. 3, 4.

The specimens described were collected from a humpback whale, taken near Cachalot, British Columbia. The one figured on plate measures: diameter 46 mm.; height, 39 mm.

Shape of shell like a cask, the sides being convex; top much smaller than base; shell symmetrical, all six compartments being of same shape; radii forming triangles with their apices at base of shell, their bases forming part of margin of the hexagonal orifice; shell thin; each compartment with four longi-

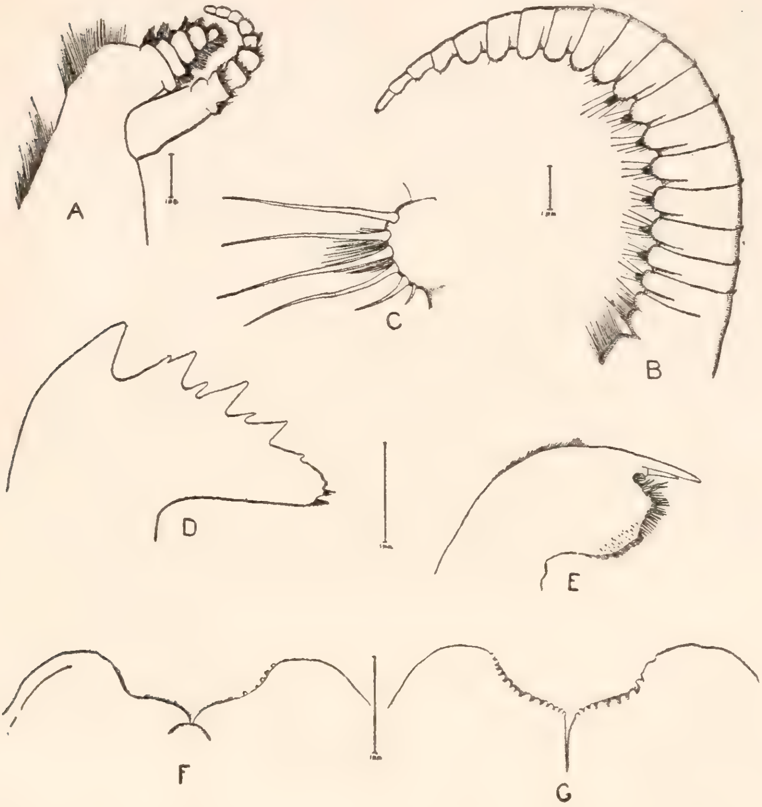

Fig. 1. *Coronula diadema* (Linnæus.) A; cirrus I. B; one ramus of cirrus VI. C; highly magnified view of median segment of cirrus VI. D; mandible. E; maxilla. F; labrum, exterior view. G; labrum, interior view.

tudinal folds; the projections between which are T-shaped, and have their transverse projections firmly pressed together; these 18 cavities are homologous with the longitudinal furrows on the compartments of some of the species of Balanus; the transverse portions of these projections forming convex ribs, which increase in number by division, the first to divide being the two marginal ones; ribs marked by fine longitudinal striæ which correspond with the septa between pores which are near the surface; these pores very small and have no cross-septa; the striæ crossed by horizontal growth-lines giving them a beaded appearance. The tops of these ribs are usually worn off, ex-

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posing the upper ends of the triangular cavities; these 18 cavities filled by the black skin of the whale; orifice closed by the thick opercular membrane which is attached near top, and nearly horizontal; it is tightly stretched; the opening for the protrusion of the cirri protected by a hood, which is nearer the carina than the rostrum and between it and the rostrum the small scuta can be seen through the membrane; no terga; the basis membranous; the basal opening small, 11 mm. in specimen figured; greatest diameter of orifice is 30 mm. in same specimen; body chamber small; its depth only equal to about half height of shell; it is cup shaped, and when the body has been removed all parts of the chamber can be seen from one point of view. Owing to the structure of the shell there is a wide space between the alæ and the radii, this space filled by the ovarian tubes which enter through the sutures; shell firmly attached by horn-like projections of skin of the whale which fill all the cavities. Shell white, cirri and mouth parts pale yellow.

Cirri (Fig. 1, A-C.), the pedicle of cirrus I is broadened in a peculiar manner, one ramus projecting sidewise from top and the other ramus being attached to edge below other; inner surfaces of first three cirri densely covered with fine spines; cirrus III set in nearer middle line of the animal than I or II and facing more toward mouth. When the first three cirri are slightly bent they form a U-shaped brush with the opening toward the mouth, and anything captured by the six long cirri would be swept into this U when they bend toward the body after each protrusion. The median segment of cirrus VI bears six pairs of spines, the lower pair being very small; in the space between the two rows of spines there is a brush-like group of small spines.

The number of segments in each cirrus is as follows:

Cirrus	I,	5—9	Cirrus	IV,	15—15
"	II,	6—9	"	V,	15—17
"	III,	9—10	"	VI,	20—21

The cirri are very tough and leathery and show signs of hard usage, many of the distal segments having the spines broken off.

Mandible (fig. 1, D.), Darwin described the mandibles of this species as having five main teeth, but in all the specimens examined from Cachalot, there are only four. On the upper side of the second tooth there is a small projection; between the second and third teeth there is a small tooth, and there is also a small tooth between the third and fourth; below the fourth tooth there is a minute tooth. The inferior angle bears several tufts of small spines, and neither the upper or lower margins have hairs.

Maxilla, (fig. 1, E.). The large spine at the upper angle is not articulated, but is an extension of the body of the maxilla; below this spine and a little to one side of it there is a smaller articulated spine; below this smaller spine there is a deep notch in which there are many fine spines; below the notch the margin forms a prominence; the inferior angle is very broadly rounded. Between the notch and the inferior angle there are two rows of spines, about 25 on each side; part of the upper and lower margins hairy; very small spines on sides of maxilla near inferior angle.

Labrum (fig. 1, F, exterior view; G, interior view), deeply notched, many small teeth set along the edge projecting inward; only a few can be seen from the exterior owing to their position, also there is a dense growth of short hairs over them. The small hard prominence at base of notch, described by Darwin, can be seen in the exterior view.

Branchiæ very greatly developed, occupying a large portion of each side of interior of sack, and almost surrounding the body of the animal; each branchia consisting of two nearly equal parts or folds, each with a tube around the free lower margin; branchiæ deeply plicated, about 15 folds in each half and the surface covered with small round protuberances which still further increase the area.

Conchoderma auritum (Linnæus)

(Plate 13, Figure 1; text figures 2-3)

1758. *Lepas aurita.* "Account of several rare Species of Barnacles," Ellis, "Phil. Trans."

1767. *Lepas aurita* Linnæus, Systema Naturæ, ed. 12, p. 1110.

1795. *Lepas leporina* Poli, Test. utriusque Siciliæ.

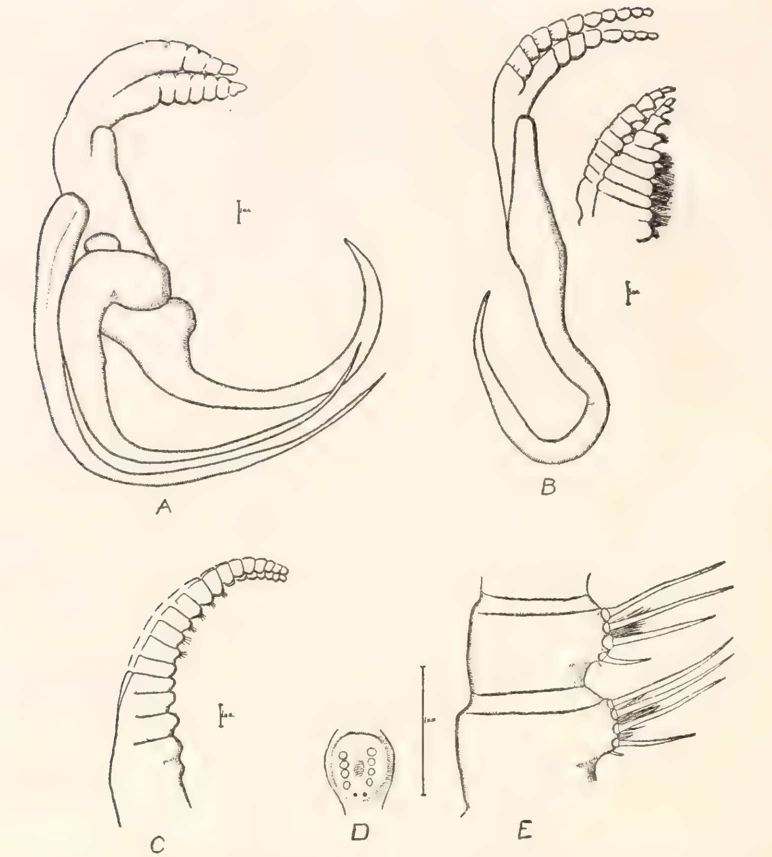

Fig. 2. *Conchoderma auritum* (Linnæus.) A; cirrus I with first, second, and third filamentary appendages attached. B; cirrus II with fourth filamentary appendage attached, also side view. C; cirrus VI. D; margin of median segment of cirrus VI showing position of spines. E; enlarged view of median segments of cirrus VI.

1814. *Conchoderma auritum* et *leporium* Olfers, Magaz. der Gessels. Naturforsch. Freunde, Berlin.

1815. *Lepas cornuta* Montagu, Linnean Transactions.

1815. *Branta aurita* Oken, Lehrbuch der Naturgesch.

1817. *Malacotta bivalvis* Schumacher, Essai d'un nouveau syst. des habitations des Vers.

1824. *Gymnolepas Cuvierii* de Blainville, Dictionnaire des Sciences naturelles.

1824. *Otion Cuvieranus* (!) *Blainvillianus* (!) *Bellianus* (!) *Dumerillianus* (!) *Rissoanus* Leach, Encyclop. Brit., vol. iii, Supp. 1824, and Zoological Journal, vol. ii, p. 208, July 1825. (From Darwin's Monograph.)

1851. *Conchoderma aurita.* Darwin's Monograph on the Sub-Class Cirripedia, the Lepadiæ, p. 141, pl. III, fig. 4.
1905. *Conchoderma auritum* Linnæus, Gruvel, Monographie des Cirrhipèdes au Thecostraces, p. 144, fig. 167.
1907. *Conchoderma auritum* Linnæus, Pilsbry, U. S. Nat. Mus. Bulletin 60, p. 99, pl. IX, fig. 2.

The following description of the genus Conchoderma, is from Darwin's Monograph, p. 137:

> "Valves 2 to 5, minute, remote from each other: scuta with two or three lobes, with their umbones in the middle of the occludent margin; carina arched, upper and lower ends nearly alike. Filaments seated beneath the basal articulations of the first pair of cirri, and on the pedicels of four or five anterior pairs; mandibles, with five teeth, finely pectinated; maxilla step-formed; caudal appendages, none."

The specimens of *Conchoderma auritum* described grew on the shell of *Coronula diadema* and were taken from a humpback whale at Cachalot, British Columbia.

General appearance: Capitulum 32 mm. in height; width 23 mm., thickness 16 mm.; two folded, ear-like appendages 23 mm. long at upper end, these larger than the appendages described by Darwin, and placed in a more erect position; (fig. 3 E, is a cross-section of these appendages showing how they are folded). The capitulum is supported on the cylindrical peduncle, which, in this specimen, is 39 mm. long and 11 mm. in diameter, expanded at base where it is cemented to the shell of *Coronula diadema.* The capitulum has an opening in the front through which the cirri are protruded; this opening surrounded by a hood; below the opening the two small scuta can be seen through the transparent outer layer of the membrane. Color faint pink, with irregular mottled patches of brown on the capitulum; peduncle irregularly striped with brown; cirri and trophi white.

Cirri short, very much flattened, tough and leathery; segments protuberant, especially those of first cirrus; dorsal tufts of spines at upper angle of each segment short and stout. On median segment of cirrus VI are five pairs of spines, (fig. 2 E), the three distal pairs being large and nearly equal in length, the fourth pair, short and curved, and the fifth pair, minute and set nearer center line of segment than the others; a brush-

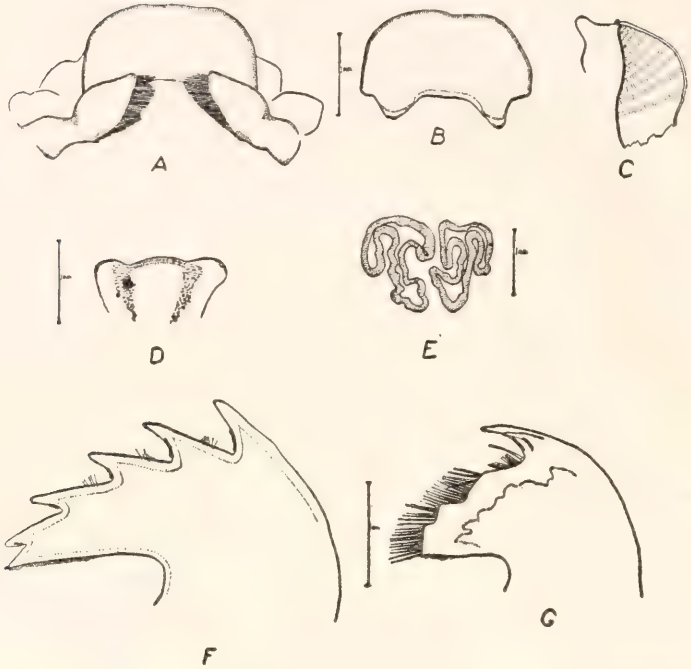

Fig. 3. *Conchoderma auritum* (Linnæus.)—A; labrum viewed from above with palpi in position. B; labrum with palpi removed. C; vertical section through center of labrum. D; interior with two patches of very fine hairs pointing toward center. E; cross-section of ear-like appendages. F; mandible. G; maxilla.

like group of small spines placed centrally between the two rows of main spines (fig. 2 D). Cirri I and II have a dense growth of fine spines on their ventral margins.

Filamentary appendages more highly developed than in any other cirripede; first two attached below pedicle of first cirrus, the third attached to its margin (fig. 2 A); the fourth, fifth, sixth, and seventh attached to the second, third, fourth, and fifth cirri, respectively. Cirrus VI has no appendage attached to its pedicle; no caudal appendages.

Mandible (fig. 3 F), with five teeth which are nearly equally spaced; the inferior angle sharply pointed and bearing a minute spine; tufts of fine hairs between first four teeth, and on each side of the teeth, near their bases, there are very minute transparent teeth; the upper and lower margins bear many fine short hairs.

Maxilla (fig. 3 G) is of a peculiar shape and somewhat resembling a mandible as the margin retreats from the inferior angle; also the two large spines at the upper angle are set on a broad base, the larger of these spines next to the mandible, both of the large spines pectinated near their bases in the same manner as the spines on mandible. In the hollow, or broad notch, below the two large spines, a long slender spine and a few small ones, the margin below the broad notch forming three steps. In Darwin's Monograph the maxilla is described as having five steps. These steps bear a dense growth of spines, the inferior angle is almost square and there are short hairs on the lower margin, with a few on the upper margin.

Labrum (Fig. 3 A,B,C,D), of the usual shape and on the crest there is a row of fine inwardly pointing teeth, with some very fine hairs.

Plate 13

Fig. 1. *Conchoderma auritum* (Linnæus), growing on shell of *Coronula diadema* (Linnæus.) Natural size.

Figs. 2-4. *Coronula diadema* (Linnæus.) Natural size.

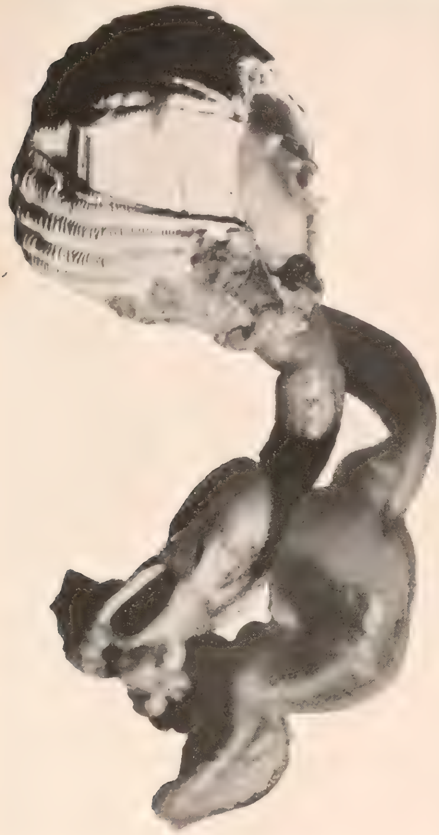

Fig. 1

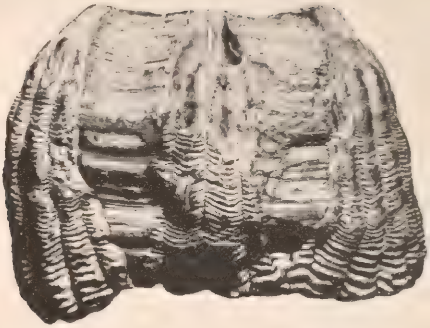

Fig. 3

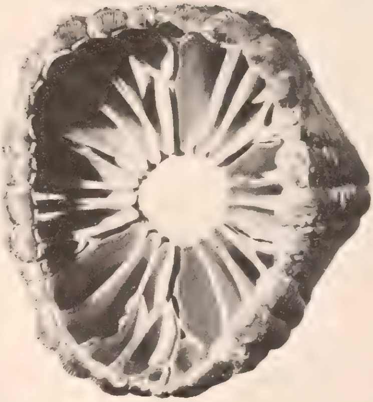

Fig. 4

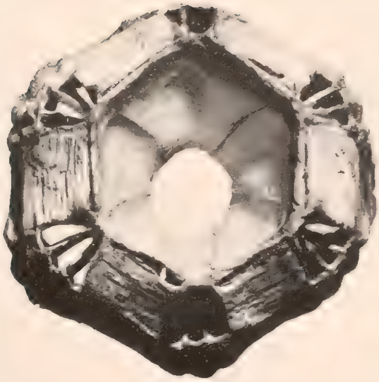

Fig. 2

PROCEEDINGS

OF THE

CALIFORNIA ACADEMY OF SCIENCES

FOURTH SERIES

Vol. XIII, Nos. 27 and 28, pp. 431-494 May 29, 1925

XXVII

REPORT OF THE PRESIDENT OF THE ACADEMY FOR THE YEAR 1924

By C. E. GRUNSKY
President of the Academy

The California Academy of Sciences has completed another successful year. While no events of outstanding importance are to be noted, the regular work of the various departments has been carried forward and the record of the Academy for continued valuable contribution to scientific research has been fully sustained as will appear from the reports of the Director of the Museum and of the curators.

Of statistical information the following is to be noted:

The membership is now at somewhat over 1100. The record for the year 1924 shows:

Members on January 1, 1924		1054
New members, during 1924		104
Total		1158
Deceased in 1924	21	
Resigned	13	
Dropped for non-payment of dues	17	
Total		51
Members on January 1, 1925		1107

May 29, 1925

The membership consists of:

Patrons	13
Honorary members	24
Life members	83
Fellows	23
Members	964
Total	1107

The Academy carries on its list of patrons the following names:

Living

Mr. George C. Beckley
Mr. William B. Bourn
Mr. William H. Crocker
Mr. Peter F. Dunne
Dr. Barton Warren Evermann
Mr. Herbert Fleishhacker
Mr. Joseph D. Grant
Mr. A. Kingsley Macomber
Mr. John W. Mailliard
Mr. Joseph Mailliard
Mr. M. Hall McAllister
Mr. Ogden Mills
Mr. William C. Van Antwerp
Dr. E. C. Van Dyke

Deceased

Mr. William Alvord
Mr. Charles Crocker
Mr. John W. Hendrie
Mr. Henry M. Holbrook
Mrs. Charlotte Hosmer
Mr. James Lick
Mr. Alexander F. Morrison
Mr. Amariah Pierce
Mr. Ignatz Steinhart
Dr. John Van Denburgh

Among those whom the Academy has lost during the year there were several whose services to the public and to the Academy were more than ordinarily notable. Without attempting even an indication of service and achievement by those in the list of deceased it will be noted that this list includes among the long-time members of the Academy Mr. A. S. Baldwin, prominent in the business affairs and the development activities of San Francisco; Mr. Harrison Barto who during many years was one of the Academy's most active members; Mr. John E. Behan, who was at the time of his death Secretary of the Spring Valley Water Company and who had been Secretary of the Board of Supervisors of San Francisco; Hon. Julius Kahn, who served his country well during a long term in Congress; Mr. Willis Polk, the distinguished architect; Mr. A. B. Spreckels, a member of the Park Commission and patron of art; Dr. John Van Denburgh, the Academy's Curator of the Department of Herpetology whose untimely passing has deprived the world of a scientist, who probably was better informed on reptiles than any other and whose passing has left a gap in the Academy's staff difficult to fill; and so on through the list which follows:

Baldwin, A. S.	Member	February 27, 1924
Barto, Harrison	Member	January 3, 1924
Behan, John E.	Member	June 20, 1924
Bennett, Robert H.	Member	November 18, 1924
Burk, Dr. Frederick	Member	June 12, 1924
Conrad, John George	Life	August 25, 1924
Drew, Frank C.	Member	May 17, 1924
Ellis, Samuel L. N.	Member	March 11, 1924
Hellmann, Anthony C.	Member	March 11, 1924
Kahn, Hon. Julius	Member	December 18, 1924
Knox, Mrs. C. C. Probert	Member	January 24, 1924
Larkin, Dr. Edgar Lucien	Member	October 11, 1924
Leonard, Charles L.	Member	January 15, 1924
Lovett, A. L.	Member	April 25, 1924
Polk, Willis	Member	September 10, 1924
Smith, Christian W.	Member	April 12, 1924
Spreckels, Adolph B.	Life	June 28, 1924
Van Denburgh, Dr. John	Life	October 24, 1924
Vierra, D. C.	Member	August 6, 1924
Woodward, Dr. Robert S.	Honorary	June 29, 1924
Worden, Clinton E.	Member	July 23, 1924

In the year 1924 eleven free lectures were delivered at the stated meetings of the Academy, as follows:

January 2.	The Red History of Black Haiti, illustrated, by Mr. M. E. Beall, Berkeley, California.
March 5.	The Wood Duck in California, illustrated, by Mr. Joseph Dixon, Economic Mammalogist, Museum of Vertebrate Zoology.
April 2.	The Significance of the Albedo and of the Color of the Planets, by Dr. Marsden Manson, San Francisco, California.
May 7.	Some Naturalists I have known, illustrated, by Dr. J. Sterling Kingsley, Berkeley, California.
June 4.	How Intelligent is the Beaver? Illustrated, by Dr. William E. Ritter, University of California.

July 2.	A Naturalist in Japan and Siberia, illustrated, by Dr. T. D. A. Cockerell, Professor of Zoology, University of Colorado, Boulder, Colorado.
August 6.	The Foundering Islands of the Pacific. Studies of Subsiding Archipelagoes. Illustrated, by Mr. Vaughan MacCaughey, Associate Editor, Sierra Educational News, San Francisco, California.
September 3.	The Pan-Pacific Food Conservation Conference at Honolulu, July 31 to August 14, 1924, by Dr. Barton Warren Evermann, Director, California Academy of Sciences.
October 1.	The California Redwoods, by Mr. Roy W. Cloud, Superintendent of Schools, San Mateo County, California.
November 5.	Some little known Relationships of Insects to Man, illustrated, by Professor Stanley B. Freeborn, Assistant Professor of Entomology, University of California.
December 3.	Camping and Climbing in the High Sierra, illustrated, by Mr. Francis P. Farquhar, San Francisco, California.

The Sunday afternoon lectures at the Museum building were continued throughout the year except during the vacation months of summer. Despite the inadequacy of the temporary lecture room, the attendance at these lectures has been satisfactory. These lectures have included the following:

January 6.	Life of the Brine Pools, by Dr. E. G. Martin, Professor of Physiology, Stanford University.
January 13.	The New Order in Turkey, illustrated, by Prof. E. G. Mears, Professor of Economics, Stanford University.
January 20.	The Laws of Heredity, illustrated, by Dr. L. L. Burlingame, Associate Professor of Botany, Stanford University.
January 27.	Heredity and Plant Breeding, illustrated, by Dr. E. B. Babcock, Professor of Genetics, University of California.
February 3.	Heredity in Man, illustrated, by Dr. L. L. Burlingame, Associate Professor of Botany, Stanford University.
February 10.	The Evolution of Man, illustrated, by Dr. Harold Heath, Professor of Zoology, Stanford University.
February 17.	The Present Status of Darwinism, illustrated, by Dr. S. J. Holmes, Professor of Zoology, University of California.

February 24.	The Trend of the Race, by Dr. S. J. Holmes, Professor of Zoology, University of California.
March 2.	The Latest Results respecting the Theory of Relativity, by Captain T. J. J. See, Professor of Mathematics, United States Navy.
March 9.	How Plants Migrate, illustrated with maps, by Dr. Douglas H. Campbell, Professor of Botany, Stanford University.
March 16.	Plant Distribution in the United States, illustrated with maps, by Dr. Douglas H. Campbell, Professor of Botany, Stanford University.
March 23.	Insect Adaptations, illustrated, by Dr. Herbert Osborn, Professor of Zoology, Ohio State University, Columbus, Ohio.
March 30.	Spring Flowers in California, illustrated, by Miss Alice Eastwood, Curator, Department of Botany, California Academy of Sciences, San Francisco, California.
April 5.	How Birds show their Feelings, illustrated, by Mr. Clinton G. Abbott, Director, San Diego Society of Natural History, San Diego, California.
April 13.	Color Changes in the Skin of the Chameleon (Anolis carolinensis), by Dr. Charles von Geldern, Sacramento, California.
April 20.	Coffee in its Preparation, illustrated, by Mr. C. B. Lastreto, San Francisco, California.
April 27.	Our Common Amphibians, illustrated, by Prof. Tracy I. Storer, Assistant Professor of Zoology, University of California.
May 4.	Uncle Sam's Weather Bureau, by Mr. E. A. Beals, Meteorologist, U. S. Weather Bureau, San Francisco, California.
May 11.	Yosemite, California's First National Playground, illustrated, by Mr. W. B. Lewis, Superintendent, Yosemite National Park.
May 18.	The Red Story of Black Haiti, illustrated, by Mr. M. E. Beall, Berkeley, California.
May 25.	The Hetch-Hetchy Valley, illustrated, by Dr. C. E. Grunsky, President of the California Academy of Sciences, and President of the American Society of Civil Engineers.

June 29.	The World War against Insects, illustrated, by Dr. L. O. Howard, Chief, Bureau of Entomology, Department of Agriculture, Washington, D. C.
October 5.	The Factors in Development: Heredity; Variation; Selection; Isolation; Running the Gauntlet of Life, by Dr. David Starr Jordan, Chancellor of Stanford University.
October 12.	Man's Place in Nature; his Origin and Development, Dr. David Starr Jordan, Chancellor of Stanford University.
October 19.	The Master Key to the Universe and the Search for it, by Dr. David Starr Jordan, Chancellor of Stanford University.
October 26.	Science and Sciosophy; Organized Knowledge versus Systematized Ignorance, by Dr. David Starr Jordan, Chancellor of Stanford University.
November 2.	Travel and Big Game Hunting in Abyssinia, Kenya Colony and Tanganyika Protectorate, illustrated, by Major Norman B. Livermore, San Francisco, California.
November 9.	Experiences of an Entomologist in the Orient, illustrated, by Dr. E. C. Van Dyke, Professor of Entomology, University of California.
November 16.	*Symposium: Kindergarten-Primary Education:* Principles of Early Childhood Education, by Miss Julia Letheld Hahn, Primary Supervisor, San Francisco Public Schools.
	Kindergarten Materials and Organization, by Mrs. Ethel Roth, Kindergarten teacher, San Francisco Public Schools.
	Primary materials and Organization, by Miss Lena Hanson and Miss Lillian Hill, Primary teachers, San Francisco Public Schools.
November 23.	The purposes of a Modern High School, by Mr. J. E. Addicott, Principal Polytechnic High School, San Francisco.
November 30.	Changing Ideals in Education, by Dr. Tully C. Knoles, President, College of the Pacific, Stockton, California.
December 7.	The College-Institution or Community, by Dr. Aurelia Henry Reinhardt, President of Mills College, Oakland, Calif.

DECEMBER 14. The Place of the Public Schools in the Program of San Francisco, by Mr. J. M. Gwinn, Superintendent of Schools, San Francisco.

DECEMBER 28. What's the Matter with our Public Schools?, by Charles Albert Adams, Esq., Attorney, San Francisco.

The continued contribution of the Academy to the advancement of science is evidenced by the following list of publications issued by the Academy in 1924:

FOURTH SERIES OF THE PROCEEDINGS

Vol. XII, No. 27, pp. 529-560—THE BEES (II) [OF THE ISLANDS IN THE GULF OF CALIFORNIA], by T. D. A. Cockerell.

Vol. XII, No. 28, pp. 561-694—THE SPIDER FAUNA OF THE SHORES AND ISLANDS OF THE GULF OF CALIFORNIA, by Ralph V. Chamberlin.

Vol. XII, No. 29, pp. 695-949—NEW MARINE ALGÆ FROM THE GULF OF CALIFORNIA, by William Albert Setchell and Nathaniel Lyon Gardner.

Vol. XII, No. 30, pp. 951-1218—THE BOTANY (THE VASCULAR PLANTS), by Ivan Murray Johnston.

Vol. XII, No. 31, pp. 1219-1222—A NEW MOUSE *(Peromyscus slevini)* FROM THE GULF OF CALIFORNIA, by Joseph Mailliard.

Vol. XII, No. 32, pp. 1223-1231—REPORT OF THE PRESIDENT OF THE ACADEMY FOR THE YEAR 1923, by C. E. Grunsky.

Vol. XII, No. 33, pp. 1232-1285—REPORT OF THE DIRECTOR OF THE MUSEUM FOR THE YEAR 1923, by Barton Warren Evermann.

Vol. XIII, No. 7, pp. 131-136—FRESHWATER MOLLUSKS OF EAGLE LAKE, CALIFORNIA, by G. Dallas Hanna.

Vol. XIII, No. 8, pp. 137-145—NOTES ON SOME ECHINOIDS FROM THE SAN RAFAEL AND TUXPAM BEDS OF THE TAMPICO REGION, MEXICO, by Merle C. Israelsky.

Vol. XIII, No. 9, pp. 147-149—DESCRIPTION OF A NEW GENUS AND SPECIES OF FRESHWATER GASTROPOD MOLLUSK *(Scalez petrolia)* FROM THE ETCHEGOIN, PLIOCENE OF CALIFORNIA, by G. D. Hanna and E. G. Gaylord.

Vol. XIII, No. 10, pp. 151-186—RECTIFICATIONS OF NOMENCLATURE, by G. Dallas Hanna.

Vol. XIII, No. 11, pp. 187-188—VOGDESELLA, A NEW GENUS-NAME FOR A PALEOZOIC CRUSTACEAN, by Fred Baker.

Vol. XIII, No. 12, pp. 189-230—Notes on the Herpetology of New Mexico, with a List of Species known from that State, by John Van Denburgh.

Vol. XIII, No. 13, pp. 231-236—The Genus Erythroneura in California (Homoptera), by E. P. Van Duzee.

Vol. XIII, No. 14, pp. 237-241—A New Species of Whale from the Type Locality of the Monterey Group, by G. Dallas Hanna and Mary E. McLellan.

Vol. XIII, No. 15, pp. 243-246—Contributions to Oriental Herpetology I. Sakhalin, by John Van Denburgh.

Vol. XIII, No. 16, pp. 247-248—On Laticauda schistorhynchus and Laticauda semifasciata, by John Van Denburgh.

Vol. XIII, No. 17, pp. 249-259—New Melyrids from Southeastern California, by Frank E. Blaisdell, Sr.

Vol. XIII, No. 18, pp. 261-303—The Ophiurans of Monterey Bay, by Raoul Michel May.

Vol. XIII, No. 19, pp. 305-324—Parasitic Bees (Epeolinæ and Melectinæ) in the Collection of the California Academy of Sciences, by T. D. A. Cockerell and Grace Sandhouse.

Vol. XIII, No. 20, pp. 325-332—Chrysididæ from Lower California, by Leland H. Taylor.

Vol. XIII, No. 21, pp. 333-339—The Bees (III) [of the Islands of the Gulf of California], by Grace Sandhouse and T. D. A. Cockerell.

Vol. XIII, No. 22, pp. 341-372—Bees of the Genus Osmia in the Collection of the California Academy of Sciences, by Grace Adelbert Sandhouse.

Vol. XIII, No. 23, pp. 373-379—Crustacea (Brachyura) [of the Gulf of California Expedition], by Mary J. Rathbun.

Vol. XIII, No. 24, pp. 381-388—Crustacea (Marcrura and Anomura) [of the Gulf of California Expedition], by Waldo L. Schmitt.

Vol. XIII, No. 25, pp. 389-420—Opisthobranchiate Mollusca, by Frank M. MacFarland.

Vol. XIII, No. 26, pp. 421-431—Notes on West American Whale Barnacles, by Ira E. Cornwall.

Although the Academy's resources are by no means adequate to provide the additional space for natural history exhibits which is sorely needed, it is, nevertheless, a fact that its material affairs are otherwise in a satisfactory condition. It will suffice in this connection to indicate the appreciation of its Market Street property. The land on which the Academy erected the Commercial Building was valued in 1909 at $544,000. A reappraisal in 1919 placed its value at $580,000. It was again appraised last year. This last appraisal showing an advance in value to $820,000.

The Academy's indebtedness of $300,000 made at the time of the erection of the Commercial Building has been further reduced by $10,000 during the past year bringing it down to $250,000 at the beginning of the current year.

Among the notable accessions to the Academy's museum there is to be noted a collection of moths and butterflies from the Henry M. Holbrook estate together with the sum of $2000 for their installation and preservation.

The presentation by Dr. E. C. Van Dyke of his entire collection of beetles to the museum of the Academy calls for special mention. This collection, embracing about 100,000 specimens, is one of the most important collections of North American Coleoptera. It is especially rich in west coast species, and consists largely of carefully studied material with many types of new species, and it at once places the Academy collection in that order of insects in a position of primary importance.

A magnificent specimen of a gorilla *(Gorilla berengeri)* was received in July for exhibition and installed at the expense of Mr. A. Kingsley Macomber.

There were many other accessions to the material in the various research departments contributed by friends of the Academy. These are greatly appreciated as they aid materially in extending the Academy's usefulness.

The management of the Steinhart Aquarium has presented no unusual difficulty. It has been kept open to the public uninterruptedly and has been extremely well attended. The Academy's requests for funds for the operation of the Aquarium during the current fiscal year were not fully met by the Board of Supervisors. The sum of $40,000 was allowed while

$44,000 had been requested. The expense of operation has been kept within the smaller allotment but not all could be done in the matter of collecting new specimens and replenishing stock which had been hoped for. While it appears probable that the City would meet any reasonable demand for this purpose above the sum named in the City budget, it has not been deemed wise to exceed the City's allowance. It will be regrettable if the funds which the City hereafter provides are not fully adequate to meet reasonable requirements.

The hearty support which has been accorded to the officers of the Academy by its membership and the extent to which the public avails itself of the opportunities which the Academy provides for enjoyment and to acquire information on natural science subjects, is a full reward for their efforts.

An account of the work which has been done in the various departments will appear in the reports of the Director and of the several curators.

XXVIII

REPORT OF THE DIRECTOR FOR THE YEAR 1924

By BARTON WARREN EVERMANN

Director of the Museum and of the Aquarium

The annual report of the Director for the year 1923 was presented to the Academy at the annual meeting, February 20, 1924.

During the year 1924 the activities of the Museum continued satisfactorily and without notable change. Additions to the Museum exhibits, the research collections, and the library were many. A number of improvements in certain exhibits and in laboratory equipment were made.

Personnel

The personnel of the Museum staff has undergone some changes in the year. Assistant janitor, George W. Edwards, became ill early in June and has not been able to resume his duties. Assistant janitor, Frank Yale, has been in poor health for most of the year, and has not been able to perform his duties since October. He was on October first given leave with full pay until December 31, 1924.

The sad death of Dr. John Van Denburgh, at Honolulu, October 24, was an irreparable loss to the Academy. The vacancy caused by his death has not as yet been filled.

The employes of the Academy on January first, 1925, were as follows: Dr. Barton Warren Evermann, Director and Executive Curator of the Museum, Editor of the Academy publications, Director of the Steinhart Aquarium, and Acting Secretary to the Board of Trustees since May first, 1924; W. W. Sargeant, Secretary to the Board of Trustees, absent on leave since May first, 1924; Miss Susie M. Peers, Secretary to the Director and Assistant Acting Secretary to the Board of Trustees since May first, 1924; Joseph W. Hobson, Recording Secretary; Mrs. Constance W. Campbell, office assistant, part time; Raymond L. Smith, office assistant; Miss Alice Eastwood, Curator, and Mrs. Kate E. Phelps, and Miss Clara

Tose, assistants, Department of Botany; Edward P. Van Duzee, Curator, Dr. F. R. Cole, Curator in Dipterology, and J. O. Martin, assistant, Department of Entomology; Joseph A. Slevin, Assistant Curator, Department of Herpetology; Dr. G. Dallas Hanna, Curator, and Eric Knight Jordan, Assistant Curator, Department of Paleontology; Joseph Mailliard, Curator, and Miss Mary E. McLellan, Assistant Curator, Department of Ornithology and Mammalogy; Dr. Walter K. Fisher, Curator, Department of Invertebrate Zoology; Frank Tose, Chief Taxidermist, James F. Campbell, Russell Hendricks, Chandler Smith, Cecil Tose, Ralph Keating, Douglas Kelly, and J. T. Wright, student assistants, Department of Exhibits; Edward P. Van Duzee, Assistant Librarian, and Miss Margaret Dold, Library Assistant; Wm. C. Lewis, janitor, Frank Ashworth, assistant janitor; Mrs. Johanna E. Wilkens, charwoman; Miss Mabel E. Phillips, checkroom attendant; J. H. Kavanaugh, day watch; Archie McCarte, night watch.

Accessions to the Museum and Library

The Accessions to the Museum and to the Library have been numerous and valuable. An itemized list will be found in the appendix to this report (pp. 479-487). A few of the more notable are mentioned in the President's report (p. 439).

Cooperation with Public and Private Schools, with Other Institutions, and with Individuals

The Academy continues to assist the schools in various ways, chiefly through loan of specimens of birds, mammals, insects, mollusks, and small habitat groups, and by public lectures. It also cooperates with other institutions and individuals as in the past.

Loans of Specimens made by the California Academy of Sciences during 1924:

January 5.	22 specimens of stone flies to Prof. P. W. Claassen, Cornell University, Ithaca, N. Y.
January 7.	34 moths to Dr. Wm. Barnes, Decatur, Ill.
January 8.	336 beetles from the Gulf Expedition material to Dr. F. E. Blaisdell, Sr., San Francisco, Calif.

January 12.	2 specimens of Phalium, Loc. 200, to Hubert Schenck, Instructor Paleontology, University of California.
February 1.	26 specimens of Noctuids to Foster H. Benjamin, Decatur, Illinois.
February 5.	119 Epeoline bees to Prof. T. D. A. Cockerell, University of Colorado, Boulder, Colo.
February 8.	33 specimens of Fucellias (kelp flies) to Dr. J. M. Aldrich, U. S. National Museum, Washington, D. C.
February 25.	1 specimen of Monardella tomentosa to Dr. J. M. Greenman, Missouri Botanical Garden, St. Louis, Mo.
February 26.	5 groups (3 bird and 2 mammal) to Berkeley Public Schools, Berkeley, Calif.
February 29.	24 specimens of Lepturid beetles to Mr. Ralph Hopping, Forest Service, Vernon, B. C.
March 6.	30 specimens of birds to Miss Sarah Wafer, 2430 Jackson Street, San Francisco, Calif.
March 10.	8 bird eggs and 4 nests to Miss Sarah Wafer, 2430 Jackson Street, San Francisco, Calif.
March 28.	25 shells to I. Magnin & Co., Grant Ave. and Geary Streets, San Francisco.
May 3.	8 birds from Regular Collection and 51 birds from School Collection to Miss Ethel Crum, Mt. Diablo Union High School, Concord, Calif.
May 23.	24 mouse traps to Mr. Classen, Associated Oil Co., Kanataka, Alaska.
June 30.	10 specimens of Melospiza (birds) to Mr. A. Van Rossem, 514 Lester Avenue, Pasadena, Calif.
July 17.	502 specimens of bees to Prof. T. D. A. Cockerell, University of Colorado, Boulder, Colo.
July 17.	219 Osmias (bees) to Grace Sandhouse, Cornell University, Ithaca, N. Y.
September 8.	2 bird eggs to Miss Findley, San Francisco Teachers' College, San Francisco, Calif.
September 12.	94 lots of marine shells from Gulf of California collection to Dr. Fred Baker, Point Loma, Calif.
September 23.	101 specimens of Rubus (plants) to Dr. L. H. Bailey, Ithaca, N. Y.
September 30.	12 speciments of Epeoline bees from Arizona to Prof. T. D. A. Cockerell, University of Colorado, Boulder, Colo.
October 10.	296 specimens of minute mollusks from Gulf of California Expedition to Dr. Fred Baker, Point Loma, Calif.
October 11.	6 specimens of ferns to Wm. R. Maxon, U. S. Department of Agriculture.
October 13.	32 specimens of Hydrochus (water beetles) to J. O. Martin, 2826 Kelsey Street, Berkeley, Calif.

October 16. 144 specimens of Tahinid flies to Dr. J. M. Aldrich, U. S. National Museum, Washington, D. C.

October 16. 550 lots of marine shells from Gulf of California Expedition to Dr. Fred Baker, Point Loma, Calif.

October 18. 152 lots of marine shells from Gulf of California Expedition to Dr. Fred Baker, Point Loma, Calif.

October 29. 26 specimens of birds to Miss Edith Newton, Cogswell School, San Francisco, Calif.

November 1 60 moths from Arizona to Dr. Wm. Barnes, Decatur, Illinois.

November 4. 40 specimens of plants from Palmer's Mexican collection of 1910 to Paul C. Standley, Smithsonian Institution, Washington, D. C.

November 12 8 specimens of salamanders to Dr. Emmet R. Dunn, Smith College, Northampton, Mass.

November 17. 3 specimens of Boraginaceæ to Ivan M. Johnston, Gray Herbarium, Cambridge, Mass.

November 18. 2 specimens of birds to Miss G. M. Findley, San Francisco Teachers' College, San Francisco, Calif.

November 25. 155 specimens of Diptera to Mr. C. Howard Curran, Department of Agriculture, Ottawa, Ont.

Visitors to the Museum

The number of visitors to the Museum in 1924 totaled 646,033, the greatest in its history. This is very gratifying, as it indicates not only sustained interest in the Museum but increased appreciation of its scientific and educational value.

The number of visitors by months and years since the opening, September 22, 1916, is shown in the following table:

Month—	*1916*	*1917*	*1918*	*1919*	*1920*	*1921*	*1922*	*1923*	*1924*
January	.....	23170	25260	17241	27013	25755	19038	15270	32364
February	.....	22058	23698	17586	23450	25679	18534	20529	44439
March	.....	31606	26810	27397	25419	28279	27922	26341	39935
April	.....	32175	23274	25994	32208	24939	36057	21911	41332
May	.....	26154	26391	28369	37107	25517	27237	37597	48152
June	.....	32123	29843	32248	36207	29406	27131	39511	58281
July	.....	37193	31420	48028	52492	43186	36263	64530	91329
August	.....	24619	31137	43730	53470	39422	34787	50849	105130
September	16448	27866	29847	34007	42013	31458	28408	69870	82814
October	36933	20629	14743	30463	33500	24861	19459	66894	43074
November	27718	21810	8531	25246	19347	18593	19080	48766	37611
December	15002	21693	19588	21188	21340	15062	13339	36707	21572
Total	96101	321096	290542	351497	403566	332157	307255	498775	646033

The number of teachers and students who come to the Museum to make use of our research collections increases each year, as does also the number of pupils with their teachers who come to study the habitat groups and other exhibits in the exhibition halls.

SCHOOLS THAT VISITED THE MUSEUM IN 1924:
San Francisco City and County

Date 1924	School	Grade	No. of Pupils	Teacher
Jan. 23	Le Conte	6	63	Mrs.Clayton,Hamilton
Feb. 3	Blue Bird Group, C. F. G.		17	
Feb. 5	Monroe	5	31	M. Wanz
Feb. 5	Monroe	5-B	30	R. Clyde
Feb. 21	Washington	1, 2, 3	11	K. S. Weiler
Feb. 22	St. Charles School	7	17	Sister M. Niceta
Feb. 29	Haight	4	66	J. E. White
Mar. 1	Presbyterian School	7, 8	15	B. D. Low (Mrs.)
Mar. 6	Portola	3A, 3B	17	M. Eddie, C. Monte
Mar. 6	Grattan	7A	8	E. Fahey
Mar. 6	Denman	5B	34	K. Kengla
Mar. 6	Farragut	6A	35	M. Spencer
Mar. 6	Farragut	6B	35	B. Beebe
Mar. 7	Hearst	8B	24	Mrs. Gibson
Mar. 7	Parkside	8A, 8B	18	M. Pollock
Mar. 7	Lincoln	8B	25	M. Turner
Mar. 7	James Lick	7B	31	L. M. Kinney
Mar. 7	James Lick	7B	33	M. M. Torpey
Mar. 8	Union High	8B	11	Miss Gibson
Mar. 8	Telegraph Hill Settlement		29	H. Avery
Mar. 10	Denman	7A	40	Esther Lawrence
Mar. 11	Buena Vista	4	12	O. Hildreth
Mar. 13	James Lick	8A	29	C. M. Weeber
Mar. 13	Farragut	2A, 2B	33	S. E. Harris
Mar. 13	John Swett	1A, 1B	25	J. T. O'Keefe
Mar. 13	John Swett	1A	30	Miss Murray
Mar. 13	John Swett	1B	29	Mrs. A. Alderson
Mar. 13	Buena Vista	4	13	O. Hildreth
Mar. 13	Washington	7A	40	W. McCullough
Mar. 14	Denman	7B	34	R. Harby
Mar. 14	Farragut	2B, 3A	22	A. Fitzgerald
Mar. 14	Jean Parker	5A	40	D. Parker
Mar. 14	John Swett	2A, 2B	75	Miss Mair Miss McCarthy
Mar. 14	Glad Tidings Bible Institute		100	H. E. Alford
Mar. 14	Jean Parker	5A, two 6A's	100	Mrs.M.Valsangiacomo A. B. Titus D. J. Parker
Mar. 14	Crocker	8A	15	C. A. Davis
Mar. 14	Emerson	5, 1, 3	35	A. Pierson
Mar. 17	James Lick	8A, 8B	62	M. McQuilkin C. Manning
Mar. 18	Lincoln	2	24	E. Patterson
Mar. 18	James Lick	8B	40	M. Cavanagh
Mar. 19	St. Joseph's Academy	5, 6, 7, 8	50	Brother Joseph
Mar. 20	Emerson	5A	35	I. Batiloro
Mar. 20	Polytechnic High	L-3, Chem	12	Hendrich
Mar. 21	McKinley	3B	12	I. Smith

Date 1924	School	Grade	No. of Pupils	Teacher
Mar. 21	Roosevelt	5A	10	E. Colrel
Mar. 21	Crocker	8	30	C. A. Davis
Mar. 22	Presbyterian Church	Boy's Choir	12	
Mar. 29	Galileo High School			Fred W. Koch
April 7	Garfield	2A, 2B	61	A. Sandell, J. Ahern
April 7	Girls' High School	1B	10	E. M. Reeves
April 7	Lincoln	5B	35	Ethel Linton
April 7	California College of Pharmacy		110	Dr. H. B. Curey
April 8	John Swett	Foreign	7	M. Inglia
April 9	James Lick	5A, 5B	46	M. Pierson
April 9	Patrick Henry	5A, 5B	31	C. S. Hunt
April 9	John Swett	1B	24	Mrs. A. Alderson
April 10	Franklin	7A	24	C. Seidken
April 11	Sherman	3	34	N. Sullivan
April 11	Lowell High	Science class	100	G. Kast
April 11	Adams	1B	18	E. Edmann
April 12	Dunham	5, 6, 7	14	Mrs. N. Jewell
April 24	St. Charles	2, 3, 4	19	Srs. Monessa, Hermosa
April 24	Francis Scott Key	5	35	C. Vandervoort
April 24	Sherman	4A	32	A. McCarthy
April 25	James Lick	7, 8	50	Miss MacKinnon Miss Vendel
April 29	Sherman	3B	35	E. A. Shipaugh
May 3	Fairmont	3, 4, 5	25	T. Tucker
May 3	Fairmont	5A	12	H. Stark
May 3	Kate Kennedy	6B	15	M. C. O'Connell
May 6	State Teachers College	Collegiate	19	G. M. Findley
May 6	Dudley Stone	3	36	L. M. Gambetz
May 6	John Muir	7, 8	18	Miss Wiggins
May 6	Cleveland	1	25	A. Curley
May 6	Emerson	5B	40	L. Miller
May 6	Excelsior	4A	42	A. Walsh
May 7	Junipero Serra	6B	30	A. B. Pidgeon
May 7	Miss Ransom's	7, 8	25	M. Thompson
May 7	Junipero Serra	6	40	F. Foley
May 7	Grattan	7A	14	M. R. Ellis
May 9	Portola	4A	32	G. Robb
May 9	Excelsior	3B	34	V. C. Mehl
May 9	Sherman	2A	28	C. M. Gates
May 9	Sherman	2B	32	E. H. Lyon
May 9	Hillcrest	3B, 4A	23	R. Jacquemet
May 9	Hillcrest	2, 3B	23	S. Peterson
May 9	Excelsior	4B	34	M. O'Shaughnessy
May 9	Bernal Grammar	5B, 6A	34	M. Gustafson
May 9	Portola	3B, 4A	30	A. Simonetta
May 10	Spanish School	A11	23	Helpers Holy Souls
May 12	Cleveland	4A, 5A	69	C. Keck E. Rosenthal
May 14	Argonne	5A	30	J. Hayes
May 14	Henry Durant	1A	26	J. R. Ambrose
May 14	Fairmont	1B	30	M. E. Traynor
May 14	Noe Valley	5B	38	F. Barton
May 15	Garfield	3B	24	M. Muirs
May 15	Roosevelt	5B, 6A	45	H. Hogrefe
May 15	Roosevelt	4A, 4B	35	F. Flinn
May 15	Commodore Stockton	5A, 5B	85	Mr. Morton Misses Belmer
May 15	Garfield	3B	26	R. Zethin
May 15	Jean Parker	2A, 1, 2B	100	E. Gumasso
May 15	Daniel Webster	3B	30	E. Kirwan

Date 1924	School	Grade	No. of Pupils	Teacher
May 15	Noe Valley	5A	41	A. T. Crowley
May 15	Michelangelo	Open Air	24	V. Dassonville
May 15	Roosevelt	A, B	28	C. Henry
May 15	Girls High	Biology	8	Muriel Pettit
May 20	California School Arts-Crafts	H. S. Grads	22	P. W. Hall
May 21	Kate Kennedy	6	29	K. Spain
May 21	St. Boniface's	Grammar	140	
May 21	Haight	6B	30	S. M. Wieland
May 21	Commodore Stockton	3A, 3B	37	M. Fitch
May 21	Daniel Webster	2B	24	M. York
May 23	Jean Parker	3, 4A, 4B	115	Misses Toye, Kains, Connelly
May 23	Portola	2B	22	J. Sheehan
May 23	Portola	2A	21	E. Ventuleth
May 23	Lazear Jr. High	9A, 9B	27	M. Partridge
May 24	Portola	4B	34	N. E. Roth
May 24	Farragut	3B	28	G. O'Connor
May 24	Marin Avenue	6	22	M. Dart
May 24	Fairmont	5B	11	Mrs. Hanlon
May 26	Girls' High	1A, 1B, Biology	19	Muriel Pettit
May 26	Hearst	3A	31	V. Gillen
May 26	Sea Cliff Kindergarten	Kindergarten	12	Miss Gardea
May 27	Moulder	5	30	M. A. Heavey
May 27	Andrew Jackson	6A	30	Helen Hefron
May 27	Kindergarten		14	Miss L. A. Wafer
May 29	Jean Parker	5B	41	B. L. Pfarrer
June 4	Everett	7A, 8A	31	Mrs. E. M. Allen
June 4	Garfield	5A	40	M. E. Watts
June 4	Garfield	4A	33	A. Doherty
June 4	Garfield	4B	33	Miss McKeon
June 5	Bay View	6B	30	A. Murphy
June 5	Rincon	1	36	A. Enewold, H. Gaines
June 5	Prescott	7	65	Fred A. Beck
June 5	Gough	1, 2	14	H. A. Ridgway, A. Alcorn
June 6	Visitacion Valley	1A, 1B	43	Misses Kelly, Mack
June 7	S. F. Neighborhood Association		23	Miss Lavers
June 10	Rincon	2, 3	47	A. P. Barry
June 11	Paul Revere	3B	35	K. Roclofs
June 11	Dudley Stone	2B	35	N. R. Gambitz
June 11	Marshall	5B	33	C. Noonan
June 13	Emerson	2B	37	C. M. Strouse
June 16	Marshall	5	80	M. A. Miller
June 17	Hawthorne	6B	27	A. Fields
June 19	Lawrence	8	13	M. B. Edwards
Aug. 27	State Teachers College	Collegiate	42	G. M. Findley
Aug. 28	Twin Peaks	2, 3A, 2B	31	Miss Hient, Mrs. Staugel
Sept. 17	John Swett	1	100	Mrs. Alderson, Misses Murray, O'Keefe
Sept. 17	Crocker Jr. High	8A	30	C. A. Davis
Sept. 18	Excelsior	4B	38	E. M. Robinson
Sept. 27	Adams	2A, 2B	27	M. Hurley
Sept. 19	McKinley	6B	26	E. Harcourt
Sept. 19	Adams	3B	23	C. Hanson
Sept. 24	James Lick	6A	40	M. MacKinnon
Sept. 24	Sarah B. Cooper	5	37	S. Borepofsky
Sept. 26	Emerson	5A	27	A. Pierson

May 29, 1925

Date 1924	School	Grade	No. of Pupils	Teacher
Sept. 26	Sarah B. Cooper	Ungraded	15	W. P. Karnes
Sept. 27	Belvedere	7, 8	10	M. Davenport
Sept. 30	Spring Valley	3B	48	M. Haller
Sept. 30	Spring Valley	3A	48	M. Fitch
Sept. 30	Emerson	5A	20	A. Pierson
Sept. 30	Dudley Stone	Kindergarten	26	L. McMurde
Oct. 2	Emerson	4A	19	M. L. Trowbridge
Oct. 2	Immaculate Conception	Biology Class III	31	Sister Alacoque
Oct. 3	Jean Parker	5B	30	D. Parker
Oct. 3	Denman	5A	33	E. Kengla
Oct. 4	Roosevelt Jr. High	9	26	S. M. Manby
Oct. 4	Ashland	4, 5	30	Miss Henshelwood
Oct. 8	State Teacher's College	Mixed	42	G. M. Findley
Oct. 8	Emerson	4	25	M. L. Trowbridge
Oct. 9	Franklin	6B	15	F. R. Curry
Oct. 10	Henry Durant	3A	25	I. O'Brien
Oct. 10	Sherman	6B	33	Furnia Davis
Oct. 10	Crocker Jr. High	7A	40	Mr. Owen
Oct. 13	St. Augustine	8	15	Sisters of Holy Names
Oct. 13	Girls High School	Campfire Group	9	Miss Pettit
Oct. 13	St. Rose Academy	Mixed	12	
Oct. 14	Emerson	4A	15	Miss Currid
Oct. 15	Sarah B. Cooper	4	39	G. Butler
Oct. 16	Patrick Henry	2	58	D. B. Carter
Oct. 23	St. Peter's	6	75	Brother Philip
Oct. 23	Argonne	Ungraded	12	May Wilson
Oct. 24	Chinese Baptist Mission	Primary	19	Effie Hoover
Oct. 27	Lowell High	10, 11	6	T. W. Jennings
Nov. 5	St. Anthony's		70	Sr. M. Bertranda
Nov. 10	St. Ignatius	College	25	George Haley
Nov. 12	Washington Irving	6A	20	A. Mansen
Nov. 13	Sheridan	8A	27	M. C. Stark
Nov. 14	Ashbury Heights Academy	High School	14	Eva Bradshaw
Nov. 18	Lowell	L2	5	L. M. Elskamp
Nov. 20	Farragut	4A	40	M. McLester
Nov. 26	Farragut	4, 5A, B	69	K. Auslen, E. McCowell
Dec. 10	State Teachers College	Nature Study	30	Mrs. I. Kane
Dec. 10	St. Ignatius	College	8	George Haley
Dec. 19	Homewood Terrace		16	M. E. White

Outside of San Francisco City and County

Jan. 1	Prescott, Oakland, 15th St. Annex	4	20	M. Fortin, M. C. Gamble
Jan. 22	Columbus, Berkeley	7, 1, 4	28	F. Shapero
Jan. 31	Homestead, San Mateo	8	8	M. Brown
Jan. 31	Lawrence, San Mateo	8	12	M. B. Edwards
Feb. 21	Piedmont Avenue, Oakland	8H	25	Edna White
Feb. 22	Troup 3, Napa		14	
Mar. 1	Livermore High	Sophmore, Junior	13	C. M. Harvey
Mar. 12	Lincoln, Berkeley	5H	34	M. Moffett
Mar. 14	Piedmont Avenue, Oakland	8	34	K. Comstock
Mar. 15	Prescott Jr., Oakland	9A, B	12	N. J. Callaghan
Mar. 20	Prescott Jr., Oakland	8B	16	L. J. Drumgold
Mar. 20	Prescott Jr., Oakland	8, 9	30	Van A. Neben
Mar. 20	Prescott Jr., Oakland	8B	16	F. M. Muller
Mar. 21	Prescott Jr., Oakland	Girls Federal	11	F. F. Moser
Mar. 22	American Canyon, Napa	4 to 8	16	M. Wallace
Mar. 24	Dewey, Oakland	Mixed	9	T. E. Hennessey

Date 1924	School	Grade	No. of Pupils	Teacher
Mar. 26	High, Oakland	Biology	22	A. C. Peterson
Mar. 27	Prescott Jr. High, Oakland	8A	29	Mrs. Grace Burrell
Mar. 28	Lincoln, Berkeley	6A	30	H. Burrough
Mar. 29	Petaluma High		35	Miss Brown
Mar. 29	University of California	Zoology 113	19	J. Grinnell
April 9	Emerson, Oakland	4B	32	E. Craig, N. Sullivan
April 14	Grant, Richmond	5A, B	27	L. Pennington
April 14	Camp Fire Girls, Crockett		21	Mrs. Searle
April 22	Emerson, Oakland	4A	29	V. Yater
April 25	Columbus, Berkeley	4B		M. Suerdermann
April 26	Camp Fire Girls, Crockett			G. I. Thoyer
April 30	Cornell, Albany	8	85	D. Azbill
April 30	Santa Fe, Oakland	6B	15	Helen W. Dodge
May 6	Prescott, Oakland	5A	37	W. Fortier
May 8	Columbus, Berkeley	6	40	E. Cloudman
May 13	Franklin, Berkeley	6	31	Mrs. E. Seabury
May 16	Emerson, Oakland	5A	31	A. S. Hoag
May 17	Evangelical Lutheran Sunday School, Alameda		20	C. T. Bauer
May 17	Grant School, Richmond	3A, B	18	Muriel Burdon
May 17	Willard, Berkeley	8A	16	E. DeLancie
May 18	Lagunitas	All grades	32	M. Charlt
May 22	Prescott, Oakland	6A, B	21	Lydia Hey
May 22	Prescott, Oakland	5A, B, 6A, B	60	Misses Hey and Gould
May 24	Richmond Jr. High	8A	12	H. W. Varnum
May 24	Mastick, Alameda	5B	21	Damkroeger
May 26	Columbus, Berkeley	1B	21	E. Engebritsen
June 3	F. C. Havens, Piedmont	6A	36	B. T. White
June 5	Prescott, Oakland	6B, 7A	63	F. Beck, F. Miller, E. Gamble
June 5	Emerson, Oakland	5A	18	E. J. Smith
June 5	Emerson, Oakland	5B	31	B. Bruce
June 7	Mastick, Alameda	5B	9	L. Damkroeger
June 7	Mastick, Alameda	4B	14	A. Rutland
June 10	Edgemont, San Bruno	8	35	T. Confoglia
June 11	San Jose High	High School	116	L. Bland
June 11	San Jose High	High School	116	L. Judkins
June 14	North Brae Com. Sunday School, Berkeley		5	Miss Keester
June 16	Millbrae, Millbrae	1-8	40	F. Schroter
Sept. 3	Epworth League, Lodi		14	
Sept. 13	1st U. P. Church, Oakland		11	L. M. Miller
Sept. 13	Notre Dame, Alameda		54	
Sept. 17	Lincoln, Berkeley	5H	30	M. Moffett
Sept. 20	University High, Berkeley	Biology 1	5	
Sept. 26	Alameda S. S.	3-5	20	T. Mizunt
Sept. 30	Hillside, Berkeley	3, 4	35	G. Watts
Oct. 6	Cole, Oakland	6A	32	G. Gardiser
Oct. 15	Piedmont Avenue, Oakland	7B	43	C. Kener
Nov. 1	Alexander Hamilton, Oakland	8B	5	L. De la Mater
Nov. 10	North Brae, San Bruno	4, 5	25	B. O'Donnell
Nov. 10	North Brae, San Bruno	6, 7	18	J. Bassett
Nov. 10	University Farm, Davis	Zoology	16	T. I. Storer
Nov. 15	Mastick, Alameda	5B	25	C. Damkroeger
Nov. 15	Mastick, Alameda	5B	16	H. F. Holt
Nov. 22	Franklin, Berkeley	Ungraded	14	C. F. Barker
Nov. 25	Jefferson, Berkeley	Opportunity	15	G. Kling
Nov. 28	San Mateo Union High	10	18	M. Dutrich
Nov. 29	Durant, Oakland	8B	20	M. S. Calder

Schools of San Francisco:		
Total Number Visiting Pupils	6382	6382
Total Number Visiting Teachers	207	
Total Number Visiting Classes	238	
Schools Outside of San Francisco:		
Total Number of Pupils	1901	1901
Total Number of Teachers	72	
Total Number of Classes	84	
		8283

Museum Activities and Growth

The activities of the respective departments are fully set forth in the reports of the curators. Only a few of the more important activities need be mentioned here.

The herbarium of the Department of Botany, under the able management of Miss Eastwood, the curator, has continued to grow rapidly in number and value of specimens. The most notable accession was a collection of 290 tropical trees, shrubs, etc., collected by Miss Eastwood in the Hawaiian Islands in August, 1924. The Department of Entomology has made remarkable advances within the year. The Van Dyke collection of coleoptera, the Holbrook lepidoptera, and the Koebele general collection, add greatly to the value of the collections of that department. The Holbrook bequest of $2000 is of special interest and value to the department.

The Department of Exhibits has made commendable progress by installing four new panel habitat groups and in collecting materials for other panel groups now in course of preparation. These little panel groups are adding greatly to the value and interest of the public exhibits. One exhibit that has long been in preparation but which is yet far from completion is that of the birds of Golden Gate Park. Another merely begun is that of the fur-bearing animals of California. It will be difficult to complete these exhibits without financial help from the outside. Because of the very great educational value to the schools of San Francisco which these exhibits will have, it ought to be possible to find one or more friends of the Academy who will supply the funds needed for their completion. A gift of a few hundred dollars, to employ competent collectors and taxidermists, would soon enable us to complete these exhibits.

The Department of Herpetology suffered an irreparable loss in the untimely and sad death, October 24, of Dr. John Van Denburgh, for many years the efficient curator of that department. The assistant curator, Mr. Slevin, spent some months in Guatemala in the interest of the department, which resulted in the addition of 2419 specimens to the collections.

The Library had a good growth during the year, the acquisitions totaling 6637 books and pamphlets; 4183 being a gift from Mr. Douglas Van Denburgh on behalf of his brother, Dr. John Van Denburgh. The Director of the Museum donated 690 miscellaneous books and pamphlets.

The Department of Ornithology and Mammalogy has had a very satisfactory year. Considerable field work was carried on by the curator and assistants, chiefly in Riverside and Modoc counties, which resulted in many desirable specimens of birds and mammals and gratifying increase in our knowledge of geographic distribution.

The Steinhart Aquarium has continued to grow in public interest and educational value, as fully set forth in the superintendent's report.

The growth of the Museum during the eight years since the formal opening on September 22, 1916, has been very gratifying. When the limited size of the building is considered, and the always very inadequate income of the Academy, and the further important fact that practically everything in the Museum (library, research collections and exhibits) has been acquired since the great fire of 1906, the growth has been scarcely less than marvelous. This has been made possible through a number of fortunate conditions or factors. In the first place, the fire of 1906 left the Academy with nothing in the way of buildings, library, study collections, or exhibits; about all that was left was a small membership filled with courage, determination and faith in the future. The Academy, not being hampered by useless or antiquated material equipment, or traditions, was free to develop rationally and in accordance with modern ideas of what a modern museum should be. And, most important of all, there has been, during the development of the Museum, the most perfect and sympathetic agreement and cooperation among the Board of Trustees, the Council, the Museum Staff, and the general membership of the Academy, as to matters of policy and the lines along which the Academy's activities should be directed and along which the Museum should develop. This unanimity of opinion and hearty cooperation have enabled us to accomplish results that would otherwise have been impossible with the limited income the Academy has.

The fact that the California Academy of Sciences is primarily an institution for scientific research has been kept constantly in mind. That it has a second function or duty educational in character, has also been recognized. There are those who would stress the scientific or research function of the Academy and minimize or eliminate altogether the popular educational activities of the Academy as functioning through museum exhibits and other channels leading out to the general public.

On the other hand, there are those who would limit or eliminate altogether the research activities of the Academy and make it purely a popular educational institution.

The management of the Academy has not accepted either of these extreme views; it regards the Academy as being both a research and an educational institution. Although primarily devoted to scientific research, the fact that we are located in Golden Gate Park on city land requires the Academy to do something for the city in return; this it is doing by maintaining a public museum and a public aquarium each open and free to the public every day in the year.

The Academy's scientific activities during the past 10 years have been the greatest in its history. The published results of studies based on the Academy's collections by the Academy's scientific staff and other specialists have in the past 10 years totaled more than 5495 pages of our Proceedings and Occasional Papers, and have greatly enriched the literature of the subjects with which they deal. The results of a number of important studies remain to be worked up or have not been published because of lack of funds. I may be permitted to call special attention to one particular piece of recent scientific work of the Academy, namely: the Academy's expedition to the Gulf of California in 1922. Although the expedition was in the field only 87 days, the collections secured were unusually large and remarkably rich in new species. Study of all the groups represented in the collections have not yet been completed, but the following figures may be given:

Total number of species listed in the reports.

Botany:	
Vascular plants	456
Fungi and lichens	20
Marine algæ	145
Mollusks	26
Insects, etc.	970
Reptiles	89
	1706

Number of new species and subspecies described:

Botany:	
Vascular plants	55
Marine algæ	106
Animals:	
Mammals	1
Reptiles	20
Insects and insect allies	425
Mollusks	13
	620

As already stated, not all the results of this expedition have as yet been published; indeed, the study of the collections in some of the groups, particularly the mollusks, has not been completed. Many more new species may be expected in the papers yet to come.

MEETING OF THE PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND ITS AFFILIATED SOCIETIES.

The eighth annual meeting was held at Stanford University, June, 25-28, 1924, in the buildings of Stanford University.

The meeting was an unusually interesting and successful one. The Academy was well represented in the attendance and on the various programs.

Dr. David Starr Jordan, President of the Pacific Division, presided at the Research Conference at noon on the 25th and in the evening of the same day gave the Presidential address, his subject being "Science and Sciosophy".

President Ray Lyman Wilbur welcomed the delegates and members to Stanford University and Dr. C. E. Grunsky, President of the California Academy of Sciences, and Vice-President of the Pacific Division, gave the response.

Other members of the Academy who were in attendance and many of whom were on the program of one or more of the affiliated societies were the following:

L. R. Abrams, Frank Adams, Robert G. Aitken, Robert Van Vleck Anderson, E. P. Babcock, T. D. Beckwith, Edward Berwick, Frank E. Blaisdell, Sr., L. E. Blochman, Douglass H. Campbell, Roy. E. Campbell, T. D. A. Cockerell, R. W. Doane, W. F. Durand, Alice Eastwood, E. O. Essig, Barton Warren Evermann, Grace M. Findley, E. C. Franklin, S. B. Freeborn, Walter M. Giffard, Frank T. Green, R. L. Green, W. A. Grubb, C. E. Grunsky, Harold Heath, L. O. Howard, Oliver P. Jenkins, Herman Knoche, C. B. Lastreto, A. O. Leuschner, E. P. Lewis, Earl G. Linsley, F. M. MacFarland, Marsden Manson, E. G. Martin, Isabel McCracken, E. P. Meinecke, E. D. Merrill, Joseph H. Moore, James McMurphy, Mary E. McLellan, Susie M. Peers, George J. Peirce, Mrs. Kate E. Phelps, C. M. Richter, Wm. E. Ritter, G. P. Rixford, N. B. Scofield, Alvin Seale, J. R. Slonaker, J. O. Snyder, Miss Clara S. Stoltenberg, Tracy I. Storer, Will F. Thompson, S. D. Townley, E. P. Van Duzee, Edwin C. Van Dyke, A. G. Vestal, F. W. Weymouth, Ray Lyman Wilbur, Bailey Willis.

First Pan-Pacific Union Food Conservation Congress, at Honolulu, July 31 to August 14, 1925.

The California Academy of Sciences was represented at this Congress by a number of its members, among whom were the following: E. A. Beals, Dr. Mary Page Campbell, Dr. T. D. A. Cockerell, Miss Alice Eastwood, Edward M. Ehrhorn, Dr. Barton Warren Evermann, Walter M. Giffard, Dr. W. B. Herms, Dr. L. O. Howard, Dr. David Starr Jordan, Eric Knight Jordan, Prof. E. D. Merrill, Dr. Herbert Osborn, Dr. Wm. A. Setchell, Dr. Hugh M. Smith, F. X. Williams.

Dr. Campbell, Miss Eastwood and Dr. Evermann were regularly appointed delegates representing the California Academy of Sciences; Dr. Howard was the permanent chairman of the Congress; Dr. Jordan, Dr. Smith and Professor Merrill were honorary vice-presidents representing respectively the United States, the Kingdom of Siam, and the Philippine government; Dr. Evermann was chairman of the section on Fisheries, Marine Biology and Oceanography. Papers were presented, and discussions participated in, by Howard, Smith, Jordan, Beals, Evermann, Cockerell, Merrill, Setchell, and others.

One of the subjects that received much attention by the Congress was that of the conservation of the marine mammals and other fishery resources of the Pacific, and the urgent necessity for an international treaty for the protection, proper utilization and conservation of marine mammals was particularly stressed.

The following resolutions prepared, approved, and submitted by the Section on Fisheries, Marine Biology, and Oceanography, were approved and adopted by the Congress:

RESOLUTION XVIII.—*Whereas,* the pollution of many coastal waters, bays, estuaries, harbors, and rivers, resulting from the discharge into said waters, of oil, ashes, and other contaminating substances by oil tankers, oil-consuming motor boats and other craft, and of waste from shore plants of oil companies and industrial plants of various kinds, has become a serious menace to sea birds, surface-swimming fish eggs and larvæ and the plankton upon which useful species feed, and to the bottom and shore life of our bays and harbors, at the same time rendering our beaches filthy, unsanitary, and unsightly; therefore, be it

Resolved, That the First Pan-Pacific Food Conservation Conference expresses the wish and the hope that the properly constituted authorities of the Pacific enter into correspondence for the purpose of bringing about an international treaty or agreement under which such pollution may be prohibited.

RESOLUTION XIX.—*Resolved,* That this conference recommends to the National Research Councils of America, Australia, and Japan, through their governments, as well as to the governments of British Malaya, China, Indo-China, the Netherlands East Indies, New Zealand, and Siam, that there be initiated as early as possible coordinated investigations into the question of the occurrence and distribution of marine borers, as well as into means of combating such organisms.

RESOLUTION XX.—*Whereas,* the sea turtles and their eggs constitute a valuable food resource in many of the countries of the Pacific Ocean; and

Whereas, the supply of such turtles throughout the Pacific Ocean, as in other oceans, has decreased greatly in recent years, and in some regions is fast approaching the vanishing point; and

Whereas, the situation has been brought about by ignorance or neglect of the fundamental requirements of the turtles, whereby there has occurred destruction of adult and young turtles and turtle eggs without regard for the future,

Be it Resolved, by the Pan-Pacific Food Conservation Conference that prompt action is necessary to save the marine turtles of various countries from commercial, if not actual, extinction, and that all Pacific nations having resources in sea turtles should forthwith take adequate steps to preserve and increase the supply, including the rigid regulation or total prevention of turtle fishing for a term of years, and, where necessary, the absolute prohibition of the gathering of turtle eggs until such time as the increased abundance of turtles would justify the taking of limited numbers of eggs.

RESOLUTION XXI.—*Whereas,* it is known that many valuable species of marine mammals such as fur-seals, sea-otters, elephant seals and whales, and many species of important food fishes, such as salmon and halibut, formerly occurred in the Pacific in such vast numbers as to constitute the objects of fisheries whose annual products were worth more than one hundred million dollars, and

Whereas, nearly all of those great natural resources have been seriously depleted, many of them even to commercial extinction, through greed, short-sightedness and ill-considered fishery methods, and

Whereas, it is known that small remnants of fur-seal and sea-otter herds and small numbers of whales and of other commercially valuable species still remain in certain places, and

Whereas, the rapid recovery of the Alaska fur-seal herd in the short period of ten years from complete commercial ruin to an annual production of more than $1,500,000, as a result of the international fur-seal treaty of 1911, demonstrates conclusively the wonderful recuperative power of such depleted natural resources of the sea under international cooperation, and justifies the belief that other depleted fur-seal herds and fisheries can be rehabilitated through similar cooperation among the nations concerned, and

Whereas, it is conservatively estimated that these resources when rehabilitated will yield to the world a regular product of more than one half billion dollars value annually; therefore, be it

Resolved, That the First Pan-Pacific Food Conservation Conference strongly urges that the various maritime countries of the world, particularly those bordering on, or interested in, the Pacific, be invited to send delegates to a convention for the purpose of negotiating an international treaty for the restoration, proper utilization and conservation of the vanishing fur-seal and sea-otter herds and other natural fishery resources of the Pacific; and be it further

Resolved, That this conference recommends that the governments of the countries bordering on the Pacific enter into correspondence for the purpose of establishing an International Commission for the scientific study of the biology, physics and chemistry of the Pacific in the interest of the restoration, proper utilization and conservation of its vanishing natural resources.

RESOLUTION XXII.—Resolved, That it be a recommendation from the First Pan-Pacific Food Conservation Conference to the various maritime countries of the Pacific area that urgent attention be directed to the study of ocean and coastal currents, and to the working up of data already available, with a view to the elucidation of important problems in navigation and commercial fisheries concerning the countries mentioned.

RESOLUTION XXIII.—*Whereas,* the First Pan-Pacific Food Conservation Conference has considered plans for a coordinated study of the food relationships of marine organisms in the Pacific area; and

Whereas, these plans call for the cooperation of the sciences of physics, chemistry, geology, zoology, botany, physiology and bacteriology, (a) in investigating the role of marine organisms in food production, (b) in promoting the cooperation of biological laboratories and other institutions in furthering such studies, and (c) in arranging the referring of materials collected to taxonomists and other specialists as an aid to the knowledge of the fauna and flora of the Pacific,

Now, Therefore, Be it Resolved, That this conference expresses its approval of the plans and suggests that the Pan-Pacific Union might give the project its support and might offer its services for the coordination of individuals and institutions engaged in each field.

USE OF THE ACADEMY LIBRARY AND COLLECTIONS BY INVESTIGATORS AND STUDENTS.

Students and investigators continue to avail themselves of the advantages of our library and study collections. These include not only members of the Academy but others who come to us for help in many ways which the Academy can give them. It is the policy of the Academy to keep on hand specimens of birds, mammals, etc., illustrative particularly of the fauna and flora of the Bay region that may be helpful to teachers in their school work.

A troup of Boy Scouts under Scout Master Harold E. Hanson continues to meet weekly in the Academy's Auditorium.

Publications by the Museum Staff

The curators and others connected with the Museum and Aquarium staffs have continued active in contributing to the literature of their respective subjects. The list of their contributions published in 1924 follows:

Evermann, Barton Warren

1. The Steinhart Aquarium of the California Academy of Sciences. <Scientific Monthly, Vol. XVIII, No. 2, pp. 149-158, 5 plates, February, 1924.
2. Об охране естественных богатств Тихого океана. <Russian Review of Foreign Trade and Markets, No. 4, pp. 10-12, February 18, 1924.
3. The Steinhart Aquarium. <Sierra Educational News, Vol. XX, No. 3, pp. 163 and 181, March, 1924.
4. The Steinhart Aquarium. <American Hebrew, Vol. 114, No. 24, pp. 756, 757 and 762, April 25, 1924. (Reprint of article in Scientific Monthly of February, 1924.
5. The American Association for the Advancement of Science; Stanford University Meeting of the Pacific Division. <Science, Vol. LX, No. 1544, pp. 103-108, August 1, 1924.
6. The Food Conservation Conference at Honolulu of Special Interest to San Francisco. <San Francisco Business, Vol. 9, No. 10, pp. 10, 11 and 19, September 5, 1924.
7. The Pan-Pacific Food Conservation Conference. <Science, Vol. LX, No. 1551, pp. 253-254, September 19, 1924.
8. Report of the Director of the Museum (of the California Academy of Sciences) for the year 1923. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XII, No. 33, pp. 1232-1285, plates 89-92, October 10, 1924.
9. The Steinhart Aquarium of the California Academy of Sciences. <Indiana University Alumni Quarterly, Vol. XI, No. 4, pp. 501-506, October, 1924.
10. The Conservation of the Fishery Resources of the Pacific. <Mid-Pacific Magazine, Vol. XXVIII, No. 6, pp. 539-546, 6 halftones, December, 1924; actually published in October.
11. Report on the Fishes collected by the Barbados-Antigua Expedition from the University of Iowa in 1918. Joint author with Alvin Seale. <University of Iowa Studies in Natural History, Vol. X, No. 4, pp. 25-41, one plate, December 6, 1924.

Eastwood, Alice

1. Trees of the Mount Tamalpais Region. <Out-of-Doors, September, 1924.
2. Annual Report, Department of Botany for 1923. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XII, No. 33, pp. 1258-1260, October 10, 1924.

Mailliard, Joseph

1. Autobiography of Joseph Mailliard. <Condor, Vol. XXVI, No. 1, pp. 10-29, January 21, 1924.
2. Woodpeckers, Pecan Nuts, and Squirrels. <Condor, Vol XXVI, No. 1, pp. 30-31, January 21, 1924.
3. Sparrow Hawk Attacking Robins. <Condor, Vol. XXVI, No. 1, pp. 34-35, January 21, 1924.
4. Census of Birds' Nests in the Music Concourse, Golden Gate Park, San Francisco, California. <Gull, Vol. VI, No. 1, January, 1924.
5. A Wintering Ground of the Yolla Bolly Fox Sparrow. <Condor, Vol. XXVI, No. 3, pp. 112-114, May 15, 1924.
6. A New Mouse *(Peromyscus slevini)* from the Gulf of California. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XII, No. 31, pp. 1219-1222, July 22, 1924.
7. Annual Report of the Department of Exhibits for 1923. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XII, Nos. 32-33, pp. 1262-1263, October 10, 1924.
8. Annual Report of the Department of Mammalogy for 1923. <Proc. Calf. Acad. Sci., 4th Ser., Vol. XII, Nos. 32-33, pp. 1265-1266, October 10, 1924.
9. Annual Report of the Department of Ornithology for 1923. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XII, Nos. 32-33, p. 1266, October 10, 1924.
10. Some New Records for Northeastern California. <Condor, Vol. XXVI, No. 6, pp. 213-217, November 15, 1924.

Seale, Alvin (with Evermann, Barton Warren)

Report on the Fishes collected by the Barbados-Antigua Expedition from the University of Iowa in 1918. <University of Iowa Studies in Natural History, Vol. X, No. 4, 1924, pp. 25-40, 1 pl.

Van Denburgh, John

1. Notes on the Herpetology of New Mexico, with a list of species known from that state. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XIII, No. 12, pp. 189-230, March 18, 1924.
2. Contributions to Oriental Herpetology, I. Sahkalin. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XIII, No. 15, pp. 243-246, November 6, 1924.
3. On *Laticauda schistorhynchus* and *Laticauda semifasciata*. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XIII, No. 16, pp. 247-248, November 6, 1924.

Van Duzee, Edward P.

1. A New Ceratocombid from Mexico. <Proc. Pacific Coast Entomological Society, Vol. II, pp. 33-34, January 31, 1924.
2. The Genus Erythroneura in California. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XIII, No. 13, pp. 231-236, March 18, 1924.
3. Characters of two North American Chermidæ. <Pan-Pacific Entomologist, Vol. I, No. 1, pp. 22-23, July, 1924. (Actual date of publication, June 28, 1924.)

4. Annual Report, Department of Entomology for 1923. <Proc. Calif. Acad. Sci., 4th Ser., Vol. XII, No. 33, pp. 1260-1261, October 10, 1924.
5. Annual Report, Assistant Librarian for 1923. <Proc. Calif. Acad. Sci., 4th Ser., Vol. VII, No. 33, p. 1265, October 10, 1924.

Conservation of Wild Life

The Academy's Committee on Wild Life continued active during the year. Special attention was given to the antelope and elk found in the state. Arrangements have been made whereby the Academy has secured the cooperation of some 20 special observers who make it their duty and pleasure to make observations and investigations from time to time regarding the wild life in their respective localities, and to make formal annual reports to the Academy. In addition, they make special reports from time to time as their observations may require. Following is a

List of Special Wild Life Observers in 1924

1.	Albright, Horace M.	Superintendent Yellowstone National Park.
2.	Anthony, Alfred W.	237 Spruce Street, San Diego, California.
3.	Courtright, George W.	Malin, Klamath County, Oregon.
4.	Cuthbert, Edmund R.	David, Chiriqui, Panama.
5.	Durbin, William G.	Susanville, Lassen County, California.
5.	Eakin, J. Ross	Superintendent Grand Canyon, National Park, Grand Canyon, Arizona.
7.	Hedderly, Edwin A.	Pacific Finance Building, Los Angeles, California.
8.	Hutchings, H. W.	Acting Superintendent Glacier National Park, Belton, Montana.
9.	Jaeger, Edmund C.	Director Riverside Junior College, Riverside, California.
10.	Karstens, Henry P.	Superintendent Mount McKinley National Park, McKinley Park, Alaska.
11.	Lee, William J.	Susanville, Lassen County, California.
12.	Lewis, Washington B.	Superintendent Yosemite National Park, Yosemite, California.
13.	Miller, John O.	Tennant, Siskiyou County, California.
14.	Ober, Edwin H.	Big Pine, Inyo County, California.
15.	Russell, Carl P.	Park Naturalist, Yosemite, California.
16.	Sanson, N. B.	Banff Museum, Banff, Alberta, Canada.
17.	Shay, Arthur T.	Upland, San Bernardino County, California.
18.	Thomson, Charles Goff	Superintendent Crater Lake, National Park, Medford, Oregon.

19 Tomlinson, Owen A.......Superintendent Rainier National Park,
Ashford, Washington.
20. White, John R............Superintendent Sequoia National Park,
Sequoia, Tulare County, California.

The census of California wild animals for 1924 was about the same as for 1923, as follows:

Mountain Sheep	about 200
Antelope	about 1000
Valley Elk	about 500;

the locations being those of our last report,

California Grizzly Bear: In November, 1924, a report was received from Col. John R. White, Superintendent of the Sequoia National Park, that a large bear had been observed a number of times in and near the Giant Forest and identified as a Grizzly Bear.

This news created considerable interest, as it had generally been supposed that this species had been extinct in California since the death in 1911 of the Golden Gate Park grizzly known as "Monarch." The identification needs verification.

It can now be definitely stated that several grizzlies have been bagged and identified since 1911. They are as follows:

October, 1916, female, from Tujunga Canyon, Los Angeles County; hunter, Cornelius B. Johnson.

August, 1922, female, from Horse Corral Meadows, Tulare County; hunter, J. B. Agnew.

There are a number of earlier dates which might prove interesting, as "Monarch" was captured about 1886. These reports are:

1895, last grizzly bagged in Yosemite National Park.

1897, male; from Tujunga Canyon, San Gabriel Mountains, Los Angeles County.

1908, two specimens from Trabuco Canyon, Santa Ana Mountains, Orange County.

Grizzly bears (but, of course, not of the California species) still occur in several of the western States, notably Arizona, Colorado, Idaho, and Montana. The latest report from the Yellowstone National Park of January, 1925, states there are some sixty (60) grizzlies at present living in the Park.

The Academy's observers' reports to December 31, 1924, from the National Parks of large game are as follows:

Mr. J. Ross Eakin, Superintendent Grand Canyon, Arizona:

Mountain Sheep	100
Antelope	35
Deer	2,650

This does not include the well known Kaibab herd which numbers 5000 or more.

The eleven (11) antelope from Nevada placed on the Tonto Plateau in the Grand Canyon are reported as doing well.

Mr. Henry P. Karstens, Superintendent Mount McKinley Park, Alaska:

Caribou	minimum	5,000
Caribou	maximum	20,000
Caribou	actual count	17,255
Mountain Sheep	minimum	300
Mountain Sheep	maximum	2,000
Moose	very numerous	
Bear	very numerous	

Mr. Chas. G. Thomson, Superintendent Crater Lake National Park, Oregon:

Bear	15
Deer	50
Elk (planted)	9

Mr. Owen A. Tomlinson, Superintendent Rainier National Park, Wash.:

Deer, blacktail	350
Bear, black	200
Goat, white mountain	250
Elk	14

Mr. Horace M. Albright, Superintendent Yellowstone National Park, Wyoming:

Elk	20,000
Buffalo	774
Antelope	395
Mountain Sheep	600
Deer, mule	1,800
Deer, Virginia white-tail	40
Moose	450
Bear, black	200
Bear, grizzly	60

The Academy received $300 from the Permanent Wild Life Protection Fund, through Dr. Wm. T. Hornaday, Trustee, for use in connection with the Academy's conservation work.

Committee for Conservation Wild Animal Life:

S. Leonard Abbott
Barton Warren Evermann
Washington B. Lewis
John R. White
M. Hall McAllister, Chairman

Needs of the Museum

It can be said that the research collections, the library and the museum exhibits have been growing as rapidly and as satisfactorily as the income of the Academy and museum space permit; in fact, they have already grown far beyond the housing capacity of the building. There is not a single department that is not terribly congested. A few illustrations may be given: In the Department of Botany all the space is so occupied as to interfere seriously with the department's work, and the curator has been compelled to place 57 large herbarium cases out in the hall, where they should not be if there were any other place for them. The Department of Herpetology is much congested and it has become necessary to store many boxes of specimens in the basement where they cannot be reached except with great difficulty. Entomology and Paleontology are even worse. The growth of these departments has been very great. Not only are their rooms chock-a-block, but the curators have been compelled to store important collections and valuable materials not only out in the halls, where they are in the way and unsightly, but even in the basement, where they are rendered temporarily valueless because of their inaccessibleness.

The Department of Ornithology and Mammalogy has greatly outgrown the two large rooms originally assigned to it, and has filled to congestion the room intended for Invertebrate Zoology.

The Library is in an even worse condition as to space; it is overcrowded everywhere. There is very urgent need for fully twice the space the Library now occupies.

May 29, 1925

The housing and proper care of the Academy's own publications has become a very serious problem. After sending to all our members and domestic and foreign exchanges, additional storage space is required each year for the Academy's reserve supply of each volume of Proceedings and Occasional Papers. There is no one room available and adequate for this purpose, and we have been compelled to use a number of different and more or less isolated or detached places, such as the lower room of the library, the room opposite the office, the store room on first floor, the lower hall, and even the check room,—a makeshift arrangement quite unsatisfactory in every way.

The only practical solution of this situation is *more space,* either in the form of a new building or through changes in, or additions to, the present building.

The best solution would, of course, be the construction of an East Wing, as contemplated in the original plans of Architect Hobart.

An East Wing would relieve the congestion in the present West Wing, provide space for museum exhibits in departments not now represented in the present exhibition halls, and, of equal or even greater importance, provide a modern up-to-date Auditorium, adequate for our public lectures and all other public functions of the Academy. The possibility of securing funds for this purpose should be carefully considered by our Trustees.

Another possibility worth serious consideration is the closing in of the Whale Court. This would be a comparatively easy matter. A glass roof of substantial construction, a floor, and a wall at the present open end are all the important structural requirements. The required interior construction and furnishings could be provided at slight expense. The entire structure would cost only a few thousand dollars, and would prove of inestimable value to the research and educational work of the Academy.

This suggestion is recommended to the Council and the Board of Trustees for their careful consideration.

With the growth of the Museum in its research collections, exhibits, library, educational activities, and material equipment, the work of the curatorial, clerical and administrative employes has increased correspondingly.

One result of its increased scientific and educational activities is that the Academy has become better known throughout the world, and especially on the Pacific Coast, as a scientific center to which an ever-increasing number of people apply for information on subjects in which they are interested. Hundreds of letters are received every year asking for information on a wide range of subjects, and many specimens are submitted for identification. It is the practice of the Director to give the information desired when possible, and, even when not possible, to send a courteous reply, all of which takes much time of the Director, the clerical force, and the curators.

As the collections increase, the curators are compelled to devote more and more of their time to their care, to purely curatorical work. Our curators, capable of doing high-class scientific work, and who should have practically all their time for research work, are compelled to devote most of their time and thought to the care of the collections, work which should and could be done by assistant curators and laboratory assistants if we had them. Fortunately, we now have such assistants in some of the departments; we should have them in all.

Another matter to which attention should be called is that of salaries. The best salaries the Academy pays its Museum and Aquarium employes are less than unskilled labor receives in some cases, and greatly less than skilled laborers get; less than grade teachers receive, and much less than high school teachers and principals receive; less than is paid assistant professors in the colleges. And it must not be forgotten that the teachers and professors are on duty fewer hours each day, only five days in the week, and only nine or ten months in the year, while the Academy employes are on duty more hours each day, five and one-half days each week, and twelve months a year, with only two weeks' annual leave! Nor do our employes receive as good salaries as are paid in other museums.

This is not just to our employes nor creditable to the Academy. Now that the Academy's income has somewhat increased, the salaries of the Museum employes can and should be increased. And, as the salaries of the Aquarium employes are less than the city pays for similar work in other places, they should be made at least equal to the latter.

Steinhart Aquarium

The Steinhart Aquarium was made possible through the public-spiritedness and generosity of the late Ignatz Steinhart, who died May 15, 1917. Mr. Steinhart gave to the California Academy of Sciences $250,000 for the construction of the building and for its equipment.

This amount was paid to the California Academy of Sciences by the executors of the Steinhart Estate (Mr. Jesse Lilienthal, Jr., and Mr. John I. Walter) December 17, 1919. As building conditions then were not good, the Trustees of the Academy voted to defer building for a time and to loan the money. This they did on the very day the money was received, and on such good terms that, up to the first of this month (February, 1925), $55,533.67 interest has been received, all of which, together with the original $250,000, has been put into the building and its equipment.

The Aquarium was completed and formally opened to the public September 29, 1923. It has now been open and in operation 17 months.

The Steinhart Aquarium is operated by the California Academy of Sciences. It is maintained by the City and County of San Francisco from funds which Charter Amendment No. 34 requires the Board of Supervisors to appropriate and pay to the California Academy of Sciences for that purpose.

For the maintenance of the Aquarium during the first fiscal year, July 1, 1923, to June 30, 1924, both inclusive, the Academy requested $40,260; the Supervisors appropriated $40,000, of which the Academy spent $39,600.70. We were able to keep within the allotment only by omitting a number of things that should have been done and by keeping the cost of operation down to the minimum. For the current fiscal year we asked for $44,000. The Supervisors have thus far allowed us only $40,000 for the year. During the first half of this year we have spent $19,778.48. The expenses during the last half of the fiscal year will be greater; for the last half of last year they were $25,182.56. This indicates that we should have not less than $50,000 annually for the efficient operation of the Aquarium.

The total number of visitors in the calendar year 1924 was 1,180,352; the total number to January 1, 1925, was 1,662,014; to February 15, 1925, 1,759,742. This is an average daily attendance of 4261.

The cost of maintenance from July 1, 1923, to December 31, 1924, both dates included, was 3½ cents per visitor.

Aquarium Personnel

The personnel of the Aquarium January 1, 1925, was as follows:

Dr. Barton Warren Evermann, Director, part time; W. W. Sargeant,* Secretary, part time; Susie M. Peers, Secretary to the Director, part time; Mrs. Constance W. Campbell, office assistant, part time; Alvin Seale, Superintendent; Wallace Adams, Assistant Superintendent; H. Walton Clark, aquarist and chief collector; William J. Martin, assistant collector; Clynt S. Martin, chief engineer; John R. Moorefield, assistant engineer; W. F. Dent, assistant engineer; Warren R. Hayes, relief engineer; Charles Brandt, chief attendant; W. S. Walker, assistant attendant; Clyde E. Guidry, assistant attendant; Peter J. Burke, janitor; Patrick O'Neill, assistant janitor; S. J. Shenefield, carpenter and general utility man; Lucie Hicks, door attendant.

Department Reports

Department of Botany

The herbarium has been increased during the past year by the addition of about 7000 specimens and 1663 species. These have come by gift, exchange, purchase and exploration, and are as follows:

Missouri Botanical Garden, 200, chiefly from the eastern United States.

Gray Herbarium of Harvard University, 1980, from the United States, Mexico, South America and Europe. Of these 1559 were unmounted and 421 mounted.

Arnold Arboretum of Harvard University, 141, chiefly woody plants.

Canton Christian College, Canton, China, 477 of the Hainan Island collection, by purchase. This collection added many species to the collection as well as many paratypes.

Dr. E. Werdermann, Santiago, Chile, 300 Chilian plants by purchase. This set of plants is most beautifully prepared and almost every specimen added a new species to our collection and several paratypes.

Mrs. Joseph Clemens, who is now in the Philippines, donated 64 specimens from the Philippines, and we purchased 742 from Texas and Oklahoma.

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*Absent on leave without pay.

Eric Walther, besides contributing 152 exotics cultivated in California, almost all new to the herbarium, has been assiduous in furnishing specimens from Golden Gate Park for the flower show in the museum.

Dr. Barton W. Evermann always collects botanical specimens when on a scientific trip and added 78 specimens with duplicates collected by him in April, 1924, in the vicinity of Cottonwood Spring, Riverside County, and 8 from Año Nuevo Island, off the coast of Santa Cruz County.

The curator collected 290 tropical trees, shrubs and weeds in Honolulu when on a trip there as a delegate to the Pan-Pacific Food Conservation Congress, also about 100 from California localities.

The following botanical centers have received duplicates of the collection made by Ivan M. Johnston on the 1921 California Academy expedition to the Gulf of California:

848 United States National Herbarium, Washington, D. C.
458 New York Botanical Garden, Bronx Park, N. Y.
584 Royal Herbarium, Kew, Surrey, England, also 70 from California.
466 University of California, Berkeley.
144 woody plants to the Arnold Arboretum, Jamaica Plan, Mass., also 137 from California.

Besides the care of a rapidly growing herbarium, the curator has devoted much time to answering inquiries which are constantly increasing, to giving popular talks on plants and the need for conservation to schools and clubs, to conducting weekly meetings or excursions of the California Botanical Club, to the bimonthly Thursday evening meetings of the ambitious gardeners of Golden Gate Park and to the flowers show in the vestibule of the museum. During the year thousands of species both native and exotic are on exhibition, each labelled with scientific and common name. Californian species have the locality designated, the exotic, their native home. Without the faithful and enthusiastic care given by Mrs. Joanna Wilkens, who keeps all clean and orderly, it would not be possible to maintain this greatly appreciated exhibit.

My regular assistant, Mrs. George H. Phelps, has been most efficient in mounting and installing the accessions and in remounting the Prager Herbarium where necessary. Much time is also given to attending to drying specimens and to miscellaneous duties.

Mrs. E. C. Sutliffe has added to the collection of Hepatics which she so beautifully has prepared for our herbarium and has been most helpful in furnishing wild flowers for the flower exhibit in the museum.

Miss Clara Tose has been employed on Saturdays and holidays since September to stamp and number the specimens in the herbarium and up to date there are about 80,000 stamped. From present indications the collection should number about 200,000 specimens.

ALICE EASTWOOD, *Curator*.

Department of Entomology

The year 1924 has been one of unusual development in the Department of Entomology. This development has been manifested, not alone in the addition of an exceptional amount of material, but perhaps equally in other lines, such as in the handling and arranging of this material. A few of the more prominent features of the year's work require special mention.

Foremost stands the acquisition of the Van Dyke collection of Coleoptera, one of the really large and important collections in this country. Dr. E. C. Van Dyke, in deeding his entire collection of beetles to the Academy of Sciences, reserved to himself the control of the specimens during his lifetime with the provision that they shall be incorporated into the general collection of the Academy and that he shall have the privilege of withdrawing such material in any group for the purpose of study, a provision of the highest value to the Academy as it assures a careful and authoritative study of the Academy collection of beetles, group by group or genus by genus, an arrangement that will result in giving the Academy an authentically determined collection in this order of insects, scarcely exceeded in value by any similar collection in this country. It is impossible at present to state the number of specimens in the Van Dyke collection but it can hardly fall short of 100,000. The work of incorporating this collection into that of the Academy is well under way, but, with the present resources of the Academy, it is not likely that it can be completed in less than two years.

Another noteworthy event was the placing in the Academy of the large and valuable collection made by the late Mr. Albert Koebele. This collection was accepted as a loan, primarily to secure it from the very immanent peril of destruction by fire and pests that menaced it in the old wooden building in which it was stored in Alameda, but also with the understanding that, if circumstances allowed, it should become the permanent property of the Academy. The lamented death of Mr. Koebele on December 28, 1924, will bring the final status of this collection up for early consideration, and it is hoped that, through the efforts of Mr. Walter M. Giffard of Honolulu and Mr. E. K. Taylor of Alameda, through whose good offices it came to the Academy, it may soon be incorporated into the Academy collection. The Koebele material is especially rich in the moths of North America, and, with our own collections, would give the Academy a fairly complete representation of the macrolepidoptera (the butterflies and larger moths) of the United States.

Another important addition to the entomological department was a collection of about 500 butterflies, mostly showy tropical forms, that was received from the estate of the late H. M. Holbrook. Mr. Holbrook accompanied his gift with a bequest of $2,000 for the proper preparation and display of the collection, an undertaking that could not otherwise have been satisfactorily accomplished with the funds available for this department of the Academy's work. The labor of mounting and determining these specimens is in the hands of Mr. J. O. Martin and is being pushed to completion as rapidly as possible.

Among the smaller but important additions to the collections in the Department of Entomology during 1924 may be mentioned a series of 3737 insects taken by Dr. E. C. Van Dyke in China and Japan during the year 1923. This lot covers all orders of insects except the Coleoptera, which form a portion of the Van Dyke collection of beetles already mentioned, and includes an exceptionally interesting series of the Hemiptera of those countries. Other accessions to the department include 1548 insects of all orders taken by Mr. J. O. Martin on a trip to Texas in the spring of 1924, and kindly presented by him to the Academy; 1061 insects presented by Mr. E. C. Burr including a really valuable series of determined European beetles; 1732 miscellaneous insects, mostly Diptera and Hymenoptera, taken by Dr. E. C. Van Dyke at and about Meadow Valley, Plumas County, California; 750 specimens of Diptera taken by Mr. C. L. Fox in southern Oregon, mostly from about Klamath Lake; 155 insects from Dr. W. W. Henderson of Logan, Utah, largely carefully determined grasshoppers from Utah. Smaller but valuable collections were received from Major Chapman Grant, Mr. Ralph Hopping, Dr. E. H. Nast, Mr. Louis Slevin, and others.

The field work of the curator in 1924 consisted of a few short trips, one to Lagunitas as the guest of Dr. Nast, and one to near Yorkville, Mendocino County as the guest of Mr. E. R. Leach. To which should be added more than 1000 moths taken by the curator at his week-end cottage at Mill Valley, principally interesting as showing the succession of these insects throughout the year. These minor trips were only supplemental to an expedition which he made by automobile into Arizona in association with Mr. J. O. Martin, and covering five weeks during July and August. Nearly a week was expended in the trip to and from Yuma, where the collecting began. From Yuma the route lay by way of Gila Bend to Phoenix and Florence, to Oracle, with a side trip to the summit of Mt. Lemon in the Santa Catalina Mts., to Tucson, Nogales, Patagonia, and to Carr Canyon in the Huachuca Mts. The return was over the same route with a stop at Florida Canyon in the Santa Rita Mts. and at Sabino and Pepper Sauce Canyons in the Santa Catalinas. The mounting of the material taken is not yet completed, so the number of specimens taken cannot be stated, but it certainly will run well over 18,000. Previous to this expedition, the Academy possessed from Arizona only the specimens picked up by Mr. Slevin during his work on the reptiles of that region, so the material secured last summer is most valuable in that it gives the Academy a fair representation of the very interesting Sonoran fauna, which finds its center of distribution in southern Arizona and northern Sonora.

From what has been said it will be seen that it is impossible to make any very accurate estimate of the number of specimens added to the Department of Entomology during 1924. The smaller lots already prepared and distributed have added 12,076 specimens, leaving the figures for the Arizona expedition, the Van Dyke collection and the Koebele collection, should that finally be secured, for separate mention next year.

The determination of material has advanced in all orders, but special mention should be made of the assistance given us by Messrs. Barnes and Benjamin in the determination of moths, and by Prof. Cockerell and Miss Grace Sandhouse in the Hymenoptera. Prof. Cockerell has worked over the more uncertain and interesting forms in several families of the bees among our North American material and Miss Sandhouse has completed the study of our Osmias. The results of her studies and much of that done by Prof. Cockerell have already been published and it is hoped the rest will soon be in print.

Another interesting feature of the work of the department is the institution of a "unit" system of arrangement, similar to that in use in the United States National Museum. By this system the specimens are arranged in small cork-lined boxes, preferably one species to a box. These boxes are about one inch in depth and 3 by 3½ inches in size, with half units and double units. As the specimens are arranged in these boxes they are placed in glass-covered trays about 18 by 20 inches in size which fit like drawers into metal-covered cases. By this system the first cost is a little greater than for the cork-lined trays formerly used, but the final cost must be considerably less, as no rearrangement is required as the collection grows, the shifting of the units being but a moment's work. So far, this system has been adopted for the Coleoptera and Hymenoptera only, but the plan is to extend it to include the Hemiptera and Diptera, and possibly other groups of the smaller insects.

Another interesting feature of the work of the department of entomology is the launching of a new entomological periodical. The members of the Pacific Coast Entomological Society have felt for some time that western entomology should have some representation among entomological serials, so last spring the society appointed a committee to perfect plans, which resulted in the founding of a quarterly publication, of 48 pages each issue, called the Pan-Pacific Entomologist, the initial number being that for July, 1924. The Committee has had to raise considerable money by private subscription in addition to a generous appropriation by the Academy of Sciences to carry it through its first year. The curator was appointed editor and the undertaking becomes in a degree one of the activities of this department. The new periodical is not yet on a self-supporting basis, and can hardly hope to be for another year or two, but the results attained seem to be well worth the effort.

Mr. J. O. Martin acted as part-time assistant during a portion of the past year but for a part of the time the curator had to do what he could single-handed. With the prospect of a full-time assistant during 1925 it is hoped that the work in the department can be kept more nearly up to date than in the past.

The general field of effort opening before the department of entomology is advancing and widening out much faster, perhaps, than the resources of the department will allow it to follow. Material is coming in faster than it can be properly cared for and case equipment is quite unable to keep pace with the growth of the collections. The large collection of Hemiptera belonging to the curator is only waiting for time and cases to be incorporated into the general collection of the department, which, when done, will give the Academy possibly the most complete collection of North American Hemiptera in the country, and other collections of insects will come as soon as the Academy is prepared to care for them.

EDWARD P. VAN DUZEE, *Curator.*

DEPARTMENT OF EXHIBITS

During the past year the chief taxidermist of the Academy, Mr. Frank Tose, has completed four more of the small habitat groups that are eventually to occupy all of the spaces between the large groups already installed in the exhibition halls of the Academy.

The four new panel groups are: Lewis Woodpecker *(Asyndesmus lewisi),* Yellow-bellied Marmot or "Woodchuck" *(Marmota flaviventer flaviventer),* Antelope Ground Squirrel *(Ammospermophilus leucurus leucurus),* and Desert Wood Rat *(Neotoma intermedia desertorum).*

Mr. Tose also spent considerable time in the field collecting specimens and accessory material for other groups to be installed as time permits. For this purpose he passed three weeks in Riverside County and about six weeks in Modoc County, California, in company with the curator and party, besides making short local trips with the same object in view. Some of the material so obtained has been used for the arranging of more of the portable groups of birds and mammals, which are in constant demand for school use. Mr. Tose also made a trip to Truckee for the purpose of obtaining material to be used in the re-arrangement of the Grizzly Bear Group, work which occupied him several weeks. For four weeks during the fall, Mr. Tose devoted his time to the work involved in the reconstruction of the tropical pool in the Steinhart Aquarium.

Mr. Tose has had under his tuition as student assistants Mr. C. P. Russell, Yosemite Park Naturalist, who passed a number of weeks in the early part of the year in the department; Mr. James F. Campbell, who came to the department on the first of December and who plans to remain with it during the coming year; and several high school students, who are sufficiently interested in the subject to spend much of their spare time in learning taxidermy and accessory work. With the assistance given by these students, Mr. Tose, in addition to his other work, succeeded in completing six more of the portable school groups as follows: California Shrike, Sierra Chickaree, Gila

Woodpecker, Spiny Pocket Mouse, Golden-mantled Ground Squirrel, and one containing sandpipers and other marsh birds.

Material for this department has been received as follows: *By expedition,* 16 mammals and 16 birds; and accessories for groups. *By gift,* Mrs. Constance Campbell, 5 specimens; and Mr. A. K. Macomber, 1.

The most valuable gift, other than habitat groups, that has ever been received by this department is that of a mounted Gorilla *(Gorilla gorilla beringeri),* from the Birunga Mountains in Belgian Congo. During a visit to England the attention of Mr. A. K. Macomber, of California, was so attracted by this fine specimen of the gorilla family on sale, that he purchased it and presented it to the Academy. This specimen is now on exhibition in the Mammal Hall of the Museum, where it has greatly aroused the interest of the visiting public.

Joseph Mailliard, *Curator.*

Department of Herpetology

At the beginning of the year 1924 the Academy's collection of reptiles and amphibians numbered 53,138 specimens. There have been added during the year 2,895 specimens, so that the collection has grown to 56,033 specimens.

The number of specimens added during each of the past six years has been about as follows: In 1919, 2666; in 1920, 1466; in 1921, 5002; in 1922, 4934; in 1923, 2132; and in 1924, 2895 specimens.

Gifts of specimens during the year have been received as follows: From Dr. H. L. Lyon, 4 specimens; Steinhart Aquarium, 20; B. Foster, 1; L. Knight, 1; Richard P. Erwin, 42; Dr. John Van Denburgh, 94; L. M. Klauber, 143; Dr. Thomas Barbour, 7; C. L. Fox, 1; Mr. E. P. Van Duzee, 1; Prof. V. M. Tanner, 1; S. H. Benstein, 1; Carl P. Russell, 2; J. V. Chapelle, 1; Edmund C. Jaeger, 1; Henry L. Helmle, 1; and J. Zenon Pasados, 17.

Specimens have been secured from 9 counties of California as follows: Marin, 3 specimens; Mariposa, 2; Riverside, 67; San Benito, 1; San Bernardino, 1; San Diego, 143; Santa Clara, 104; Santa Cruz, 1; and Sonoma, 1.

Specimens from other localities are: Idaho, 42 specimens; Indiana, 12; Louisiana, 1; Nevada, 2; North Carolina, 9; Oregon, 1; Pennsylvania, 1; Africa, 9; Canada, 12; China, 4; Costa Rica, 1; East Indies, 9; Fiji Islands, 7; Guatemala, 2419; Hawaiian Islands, 6; India, 2; and Philippine Islands, 35.

The department received from the late Dr. John Van Denburgh, through Mr. Douglas Van Denburgh, a valuable library, consisting of 1437 books and separates on Herpetology, and about 200 negatives and prints of west coast reptiles and amphibians, besides many miscellaneous photographs of reptiles.

Three papers were published during the year as follows: Notes on the Herpetology of New Mexico, with a list of species known from that state; Contributions to Oriental Herpetology, I. Sakhalin; On Laticauda schistorhynchus and Laticauda semifasciata.

The classification, labeling, cataloging, and arrangement of the collection was continued during the year.

Field work was carried on in Guatemala, resulting in a collection of 2419 specimens. The thanks of the department are due Señor E. Skinner Klee, Consul General of Guatemala at San Francisco, who very kindly furnished credentials and arranged the necessary details for entering the port of San Jose de Guatemala, and Señor J. Zenon Pasados, at whose invitation a stop of six weeks was made on his plantation near Samayac, where the most valuable part of the collection was secured.

Joseph R. Slevin, *Assistant Curator.*

Library

The growth of the Academy library during 1924 has been somewhat greater than in the preceding year and the administrative work has been kept well up to date. The total additions to the library number 6,637 items, of which 1,640 are publications of societies and institutions received in exchange for the Academy publications, and 3,947 are pamphlets, excerpts, reports, etc., received as gifts. 175 complete volumes were added by purchase and 130 by gift. Of the donations received, the most important was a collection numbering 4,183 items received from the estate of the late Dr. John Van Denburgh, and 690 items presented by Dr. Barton W. Evermann. Among the books acquired by purchase are the following of special interest: Dawson, Birds of California, 4 vols.; Annals of the Lyceum of Natural History of New York, a complete set of this very important serial in 11 vols.; Journal of the Quekett Microscopical Club, 13 vols.; Stettiner Entomologische Zeitung, 25 vols. in 8; Walker, List of the Lepidopterous Insects in the British Museum, a complete set of this very scarce publication in 20 volumes; l'Illustration Horticole, 16 vols., and the Bulletin and Memoirs of the Societie Botanique de France in 71 volumes.

Press of other duties made it necessary for Mrs. Helen Van Duzee to relinquish her duties in the library in May. Later Miss Margaret Dold was appointed as library assistant and entered upon her duties on October 1. Through the faithful efforts of these two, the library work has been kept up to date and some advance has been made along all lines of library activities. All new books have been accessioned as received, exchanges have been collated and placed on the shelves and much has been done to improve the arrangement on the shelves containing the recent accessions, and in arranging and labelling the material in the lower library.

The books and pamphlets in the departmental library of the Steinhart Aquarium have been accessioned, and for a good proportion of these the main catalogue cards have been written. This work has been done in a most satisfactory manner by Miss Lucie Hicks in time she could spare from other duties.

The use of the library has shown a regular and satisfactory increase during the year.

Edward P. Van Duzee, *Assistant Librarian*

Department of Mammalogy

During the year 1924 all of the material belonging to this department has been carefully overhauled by the assistant curator, Miss Mary E. McLellan, who has put into proper condition for preservation practically all of the remaining unprepared osteological specimens. Miss McLellan has also identified many of the heretofore unnamed specimens of mammals and has all of the collections finally so arranged as to be readily available for study and comparison.

Conjointly with that of the Department of Ornithology, considerable field work has been carried on, principally in Modoc County, California, where several species of rodents, not recorded previously from the northeastern part of the state, were taken. Many specimens of the smaller mammals were obtained in April during three weeks passed in Riverside County, California, and several short trips were made in the vicinity of San Francisco with special objects in view.

Accessions to the collections during the year have been as follows: *By expedition,* 337 specimens. *By gift,* Mr. John Addleman (through Dr. G. Dallas Hanna), 1 specimen; California State Department of Agriculture, 1; Mrs. Constance Campbell, 1; Mr. M. Hagiwara, 1; Mr. H. O. Harrison, 4; Master Russell Hendricks, 1; Mr. J. N. Kavanaugh, 1; Mr. A. K. Macomber, 1; Mr. John McLaren, 3; Mr. W. M. Phillips, 2; Mr. C. P. Russell, 6; Steinhart Aquarium, 4; Miss Ruth Tilbury, 1.

Joseph Mailliard, *Curator.*

Department of Ornithology

Considerable additions have been made to the collections of birds and birds' eggs in the past year, and field work has received more than the usual amount of attention. A field party, consisting of Dr. Barton Warren Evermann, Mr. Frank Tose, and the curator, with Mr. Jack Malloch as general assistant, passed three weeks of the month of April in Riverside County, California, chiefly at Cottonwood Spring, collecting specimens and accessory material. A party consisting of Mr. Tose, the curator, and assistant Malloch, spent the time from May 20 to June 20, in Modoc County, California, and the first 10 days of May in Tehama County, on the way north from San Francisco. Assistant Malloch and the curator returned to Modoc County on September 3, and remained there until October 9. All of these field trips were made with automobile and full camping equipment, and during their course much excellent material for the collections and for the habitat groups was obtained and new light was thrown upon the matter of the geographic distribution of some of the birds and mammals of the state.

The work of identifying, arranging, and taking care of the specimens belonging to the department has been carried on by the assistant curator, Miss Mary E. McLellan. Frequent accessions to the collections demand that more and more time be given to curatorial work, but, in spite of this, Miss McLellan has matters so well in hand that she has undertaken some systematic work in addition to her regular duties.

The oölogical division of this department has received two collections worthy of note. One of them was from Dr. Harry R. Painton, one of the founders of the Cooper Ornithological Club. This collection was made chiefly in the '90's, and contains some material that is constantly becoming more difficult to secure. The other collection was that made by the late Dr. John Van Denburgh, and was donated to the Academy by his brother, Mr. Douglas Van Denburgh. These two collections add very materially to those already installed in this department.

Accessions to the Department of Ornithology during 1924 are as follows: Bird skins: *By expedition,* 497 specimens. *By gift,* Mr. H. Babcock, case containing two mounted specimens; Mr. E. W. Gifford, 1 specimen; Mrs. J. C. Hawver, 2; Mr. J. N. Kavanaugh, 1; Mr. E. H. Kennedy, 1; Mr. Leverett Mills Loomis, 1; Mr. Thomas P. Mailliard, 1; Mr. John McLaren, 1; Mrs. Will Morris, 1; Dr. Harry R. Painton, 43; Mr. C. H. Sawyer, 1; Mr. Chandler Smith, 6; Mr. J. W. Steinbeck, 1; Dr. J. M. Stowell, 1; Mr. Frank Tose, 2; Dr. John Van Denburgh, 1; Mrs. Johanna Wilkens, 1.

Nests and birds' eggs: *By expedition,* 6 sets (14 eggs). *By gift,* Mrs. Elizabeth Brickdale, 1 set and nest; Dr. Barton Warren Evermann, 1 nest; Miss Clare Elizabeth Johnson, 1 set and nest; Mr. John Ward Mailliard, 1 set and nest; Mr. Joseph Mailliard, 28 sets; Mr. J. W. Martin, 1 set; Dr. Harry R. Painton, 386 sets (1160 eggs) and 36 nests; Dr. John Van Denburgh (through Mr. Douglas Van Denburgh) 1311 sets (4667 eggs) and 16 nests.

Joseph Mailliard, *Curator.*

Department of Paleontology

The activities of the Department of Paleontology during 1924 have consisted very largely in microscopical research in connection with the production of petroleum in California. The arrangement with the Pacific and Associated oil companies mentioned in the report for 1923 was continued during the year. In May it was decided that the investigations had shown so decided a value to the petroleum industry that these companies established a fully equipped laboratory at their downtown office, 79 New Montgomery Street, San Francisco. This was done in order that closer touch could be had with exploration work being conducted than was possible when the investigations were being conducted in the Academy building.

The arrangement made has resulted in the acquiring by the Department of incomparable collections of microscopical fossils. The institution also justly deserves most of the credit for bringing this branch of science into immediate economic usefulness, which must, of course, be the guiding stimulus, ultimately, of all research. The appreciation of the actual value of the work is best stated by others, but it is fitting to note that all of the young men who have been associated with the curator in the work thus far have been placed in responsible positions in charge of microscopical examinations for various large producing oil companies. A list of these men is well worth recording, and is as follows:

Mr. Hershel L. Driver, Standard Oil Company of California.
Mr. Marcus A. Hanna, Gulf Production Company of Texas.
Mr. Roy T. Hazzard, John Hayes Hammond interests.
Mr. H. M. Horton, Marland Oil Company of California.
Mr. Donald R. Hughes, Marland Oil Company of California.
Mr. Merle C. Israelsky, Rycade Oil Company of Texas.

Investigations in other branches of paleontology than microscopy have not been allowed to lapse because of the activity with the smaller fossils. A large collection of mollusca was made by Mr. L. C. Decius and the Curator in western Washington and Oregon.

A very large collection of bones of vertebrate animals, chiefly marine, was obtained at Shark Tooth Mountain, Kern County, California. This was made possible through cooperation of the Pacific Oil Company, on whose property the deposit lies, and particularly through the activities and interests of Mr. Charles Morrice of the company. For four months, Mr. Tom Harbert was employed by the Academy to assist in the excavation work and altogether over a thousand bones were taken out. The collection is now in the hands of Dr. Remington Kellogg in Washington for study and report through aid granted by the Carnegie Institution of that city.

Routine work of the department was carried on by a full time assistant, Mr. Merle C. Israelsky, until his departure in February, and much in the way of cataloging and arranging of collections in systematic order was accomplished. No one was available for such duty again until October, when Mr. Eric K. Jordan came to the department in the same capacity. Mr. Jordan has specialized thus far on late Tertiary and Pleistocene sediments and it was particularly fitting that he should begin the systematic assembling of the very large collections of these ages made by the curator in Lower California in 1922, when a member of the joint expedition sent to Guadalupe Island and elsewhere by the Academy and other institutions. Detailed work on these collections had been practically completed at the end of the year, much to the gratification of western students who have heretofore had no collection from that region for consultation.

Work on the marine shells and fossils collected by the Academy's expedition to the Islands in the Gulf of California in 1921 was continued by Dr. Fred Baker of Point Loma, California, and, although completion of reports seems long delayed, very satisfactory progress has been made, when the enormous size of the collections concerned is taken into consideration.

Outstanding loans of material from the department for scientific study at the close of the year were as follows:

Dr. Fred Baker, Point Loma, California, recent mollusks from the Gulf of California.

Dr. Paul Bartsch, U. S. National Museum, Washington, D. C., recent mollusks from the Galapagos Islands.

Dr. S. S. Berry, Redlands, California, recent chitons of the Gulf of California.

Prof. Bruce L. Clark, University of California, Berkeley, fossils mollusks from western states.

Dr. Remington Kellogg, U. S. Department of Agriculture, Washington, D. C., Miocene vertebrates from Kern County, California.

Prof. F. M. MacFarland, Stanford University, California, recent marine mollusks from the Gulf of California.

Dr. Mary J. Rathbun, U. S. National Museum, Washington, D. C., fossil crustaceans from western states.

Prof. Hubert Schenck, Stanford University, California, fossil mollusks from western states.

G. Dallas Hanna, *Curator.*

Steinhart Aquarium

The Steinhart Aquarium continues to be one of the most popular public institutions in the city. The attendance, especially on Sundays and holidays, is always too great for comfort or for seeing the specimens to the best advantage. The total attendance during the year was 1,180,352.

On January 1, 1925, the specimens in the tanks numbered 6208, representing 301 species. This is an increase of 124 species over that of last year. These are divided among the animal kingdom as follows:

Mammals	11 specimens	4 species
Birds	1 specimen	1 species
Reptiles	127 specimens	39 species
Batrachians	56 specimens	3 species
Fishes	5744 specimens	239 species
Invertebrates	269 specimens	15 species
Total	6208 specimens	301 species

This is exclusive of 10,000 eggs and numerous young fish in the hatchery which is now in operation and a source of great interest and instruction to visitors.

Tropical fishes from the Hawaiian Islands now number 401 specimens of 66 species, and form a most attractive exhibit.

All of the adult seals and sea lions in the outdoor pools have continued in excellent health; the only mishap being that which befell the baby Leopard Seal born in Pool A, May 1, 1924. This young seal choked to death on a peanut hull thrown into the tank by a careless bystander. An additional female Leopard Seal was put into this tank December 12, 1924.

The Swamp has been rearranged by Mr. Tose and Mr. Clark and presents a very attractive appearance.

The Laboratory has been provided with lockers, aquariums, and an adequate equipment of microscopes, microtomes, stains and reagents, so that research work may be undertaken by qualified persons.

The Library has been catalogued by Miss Hicks and all pamphlets have been filed under their respective subjects.

The personnel of the Aquarium remains the same except a few minor changes in the engineering force. It is a pleasure to state again that all members of the Aquarium staff have performed their duties willingly and efficiently; they have put in many hours of overtime without complaint and without compensation. I hereby wish to acknowledge my appreciation of these services and to extend my thanks for the same.

Alvin Seale, *Superintendent.*

Accessions to the Museum and Library for 1924

Addleman, John, 727 Victoria Street, San Francisco: 1 Redwood weasel *(Mustela xanthogenys munda),* in flesh, from San Francisco, Calif. Gift.

Aldous, Harry, 228 West First North Street, Salt Lake City, Utah: *Catoptrophorus s. inornatus,* ¼n, ¼, and skin; *Numenius americanus,* ¼n, ¼. Exchange.

Allyne, Miss, 2609 Gough Street, San Francisco: A shoe worn by the women of Damascus in 1893, the inlaid parts being camel's bone and silver; a pipe, believed to have come from the Philippines; a small Philippine pipe, 1898; and 1 photograph. Gift.

Anthony, A. W., San Diego, California: Sixteen land shells from Turtle Bay, Lower California; 1 crab; and 4 fish *(Azurina hirundo).* Gift.

Arnold, Arboretum, Boston, Mass.: 141 specimens of trees and shrubs from Western States. Exchange.

Bailey, H. H., P. O. Box 5, Miami Beach, Florida: *Passerherbulus nigrescens,* n/3, and pair of skins; *Cerchneis sparveria paula,* 2/4; *Aphelocoma cyanea,* n/4. Exchange.

Babcock, H., 2660 Scott Street, San Francisco: 1 glass case containing 2 mounted birds *(Scolopax rusticola* and *Perdix perdix).* Gift.

Baker, Dr. Fred., Point Loma, California: 45 specimens of mollusks (4 species), one cotype, of land snail from Brazil; 6 lots miscellaneous marine and fresh water mollusks and brachiopods and 3 cotypes of *Bernardina bakeri* Dall; 1 specimen of *Dentalium splendidulum* from Lower California; 31 species of marine shells from Point Loma, Calif. Gift.

May 29, 1925

Bard, Mrs. Mary, Hueneme, California: 9 specimens of exotic plants from Ventura County, Calif. Gift.

Benstein, S. H., San Francisco: One salamander from Marin County, Calif. Gift.

Bethel, Ellsworth, State Building, Denver, Colorado: One specimen of plant from Boulder, Colorado. Gift.

Blanc, A., San Francisco: One piece of petrified wood from Calaveras County, which burned and turned to jasper in the San Francisco fire of 1906; 10 pieces of native antimony from Erskin Creek, Kern County, Calif.; one Indian stone bowl with lid from near the City of Mexico. Gift.

Block, Roland M., 3522 Fulton Street, San Francisco: Two botanical specimens from Kings Mountain, California. Gift.

Bolton, Miss Florence, Hueneme, Calif.: 12 botanical specimens from Ventura County, Calif. Gift.

Brickdale, Mrs. Elizabeth, 1315 Stanyan Street, San Francisco: Eggs of Western meadowlark *(Sturnella naglecta)*, 1/5n, from San Francisco. Gift.

Brimley, C. S., Raleigh, North Carolina: Six salamanders from North Carolina. Purchase. Six salamanders from North Carolina. Exchange.

California State Department of Agriculture: One *Herpestes mungo*, in flesh, from India. Gift.

California State Mining Bureau: Lower jaw of Desmostylus, 2 lots of tertiary fossils, all from Mendocino Coal Mine, Dos Rios, California. Loan.

Campbell, Mrs. C., Mill Valley, Marin County, Calif.: One *Neürotrichus gibbsii hyacinthinus*, in flesh, from Marin County, California; 5 *Sylvilagus audubonii audubonii*, from Golden Gate Park, San Francisco. Gift.

Canton Christian College, Canton, China: 476 specimens of Chinese plants. Purchase.

Chandler, Miss Katherine, 113 Duncan Street, San Francisco: One botanical specimen. Gift.

Chapelle, J. V., Hesperia, Calif.: One rattlesnake from California. Gift.

Clemens, Mrs. Joseph, Manila, Philippine Islands: 64 specimens of plants from Philippines. Gift. 742 botanical specimens, chiefly from Texas and Oklahoma. Purchase.

Coleman, George A., Berkeley, Calif.: Nine specimens of freshwater bivalves from Rae Lake, Calif. Gift.

Coleman, R. A., California Fish and Game Commission: Two lots of freshwater mollusks from the Klamath River region. Gift.

Cornwall, Ira E., Victoria, British Columbia: Three species of barnacles, 40 specimens, from British Columbia; Plesiotype of *Conchoderma auritum;* 3 species of crabs, 4 specimens, from British Columbia. Gift.

Cramsie, Mrs. E. C., Smartsville, Calif.: One botanical specimen. Gift.

Cummings, Mrs. J. H., Wilmington, North Carolina: Five botanical specimens. Gift.

Dale, W. E. S.: One piece of lava and 17 land shells from Hawaii. Gift.

Davison, Edgar B., San Luis Obispo, Calif.: One botanical specimen from Cambria. Gift.

Donohoe, Mrs. Joseph A., 8 Oak Park Grove, Menlo Park, Calif.: One specimen of exotic plant. Gift.

Downieville High School, Sierra County, Calif.: Two botanical specimens. Gift.

Eastwood, Miss Alice, California Academy of Sciences, San Francisco: 290 specimens of Hawaiian plants; 24 botanical specimens from Ventura County; 8 botanical specimens from Mt. Hamilton. Exploration. 2 botanical specimens from Mt. Tamalpais; 27 specimens of California plants. Gift.

Ehrhorn, Edward M., Honolulu, Hawaiian Islands: 280 specimens (82 species) of land shells from Hawaii. Gift.

Erwin, Richard P., Boise, Idaho: Five snakes, 5 lizards, 19 frogs from Idaho. Gift.

Evermann, Dr. Barton Warren, California Academy of Sciences, San Francisco: 690 books and pamphlets and one nest of California Jay *(Aphelocoma californica californica)* from Contra Costa County, Calif. Gift. 78 specimens of plants from Cottonwood Spring, Calif., and five specimens of minerals from northeast of Mecca, Calif.; three sets of eggs of Pigeon Guillemot *(Cepphus columba),* one albino young Steller Sea Lion *(Eumetopias stelleri),* from San Mateo County, Calif., and 8 specimens of plants from Año Nuevo Island, Calif. Exploration.

Fouke Fur Company, St. Louis, Missouri: 800 feet of motion picture films of Fur Seals. Gift.

Fox, C. L., 1621 Vallejo Street, San Francisco: 156 freshwater shells from Upper Klamath Lake, Oregon; 30 botanical specimens from Tulare County, Calif. Gift.

Frevert, Emily H., 3535 Fruit Street, San Diego, Calif.: 81 specimens of begonias. Gift.

Galapagos Expedition 1906: 856 fossils from 10 localities, 8 on Galapagos Islands, 1 on Coccos Island, 1 on Cedros Island. Exploration.

Giffard, Walter M., Honolulu, Hawaii: 563 specimens of freshwater shrimp *(Caridina brevirostris* Stimpson), from Pohoiki, Lower Puna, Island of Hawaii, August 15, 1924. Gift.

Gifford, Edward Winslow, Museum of Anthropology, Affiliated Colleges, San Francisco: 1 *Henicophaps albifrons,* in flesh, from New Guinea. Gift.

Gray Herbarium, Harvard University, Cambridge, Mass.: 1890 specimens of plants, 1559 unmounted and 421 mounted from Idaho, California, Venezuela, Curaçao, Peru, Bolivia, Chile, China, Long Island, Quebec. Exchange.

Hagiwara, M., Japanese Tea Garden, Golden Gate Park, San Francisco: 1 monkey (Semnopithecus?) in flesh. Gift.

Hall, Dr. H. M., Carnegie Institution of Washington: Three specimens of California plants, also 7 mounted and 86 unmounted specimens of plants from the Carnegie Institution. Gift.

Hanna, Dr. G. Dallas, California Academy of Sciences, San Francisco: 36 freshwater shells from Donner Lake and Truckee River, Calif.; Geological Survey of Kansas, Vol. 9, 1908; U. S. National Museum, Vol. 64, Art. 13, 1924; University of California Publications in Zoology, Vol. 24, No. 3, 1924; 5 excerpts; Proceedings United States National Museum, Vol. 64, Art. 3, pp. 1-6; Proceedings United States National Museum, Vol. 64, Art. 8, pp. 1-28; Condor, March-April, 1924; Bryant Walker's Ancylidæ of South Africa; University Publication in Zoology, Vol. 22, No. 14, 1924; United States Geological Survey Map of Alaska, map of United States, Index map of United States (2 maps), 5 circulars; Academy of Natural Sciences, Proceedings, 12 excerpts; United States National Museum Bulletin 100, Vol. 5, and 115; Proceedings 4 excerpts; North American Fauna, No, 45; California State Mining Bureau, Mining in California, Vol. 18, No. 1, 5, 6, 9, 10, 11, 19; No. 2, 3, 4; California State Mining Bureau Preliminary Report No. 8; Michigan University Occasional Papers. No. 106, 135 (16 excerpts, 12 pamphlets). Gift.

Hanna, Marcus A., Instructor in Geology, University of Washington, Seattle, Washington; 15 *Dendrastus excentricus* (dried specimens). Gift.

Harlow, B. C., State College, Pennsylvania: Tennessee Warbler, n/7 (152), n/6 (147); Bay-breasted Warbler, n/6; Cape May Warbler, n/6; Lucy Warbler, n/4; Blue-winged Warbler, n/5; Myrtle Warbler, 1/4; Junco, 1/5; White-throated Sparrow, 1/4; Blue-headed Vireo, 1/4; Marbled Godwit, 1/4 (2-13-24). Exchange.

Harrison, H. O., 1200 Van Ness Ave., San Francisco: Hides and horns of 4 Rocky Mountain Sheep from Yukon District, Canada. Gift.

Hart, Cecil, Route 6, Box 432, Los Angeles, Calif.: 53 botanical specimens from southern California; 19 botanical specimens from San Bernardino County. Gift.

Haslett Warehouse Company, 3rd and Townsend Street, San Francisco: 1 box of shells and curios originally collected by George Woodworth. Gift.

Hawver, Mrs. J. C., Bolinas, Calif.: 1 Western Redtail Hawk and 1 Dusky Horned Owl, both in flesh, from Marin County, Calif.

Hebard, Morgan, Academy of Natural Sciences, Philadelphia, Penn.: *Capnobotes fuliginosus* Thomas, 1 male, 1 female; *Ateloplus luteus* Caud., 1 male, 1 female; *Eremopedes balli* Caud., 1 male, 1 female. Exchange.

Hendrick, Master Russell, 1166 Guerrero Street, San Francisco: 1 *Mus musculus musculus,* in flesh from Golden Gate Park, San Francisco. Gift.

Hudson, Dr. W. J., Ukiah, Calif.: 1 specimen of plant. Gift.

Hunt, Mrs. Clara, St. Helena, Calif: One botanical specimen from Napa County, Calif. Gift.

Jackson, Mrs. Belle Richardson, San Rafael, Calif.: 9 botanical specimens from Mt. St. Helena.

Jaeger, Edmund C., Riverside, Calif.: One lizard from Riverside County, Calif. Gift.

Johnson, Miss Clara Elizabeth, City Hall, San Francisco: Nest and eggs of California Shrike *(Lanius ludovicianus gambeli),* from Alameda County, Calif. Gift.

Jordan, David Starr., Stanford University, Calif.: 35 shark teeth. Gift.

Kavanaugh, J. N., California Academy of Sciences, San Francisco: 1 *Phasianus torquatus,* in flesh, and 1 *Sciurus niger rufiventris,* from Golden Gate Park, San Francisco. Gift.

Kelly, Mrs. G. Earl, 1311 Grand Street, Alameda, Calif.: 8 specimens of plants from Lake Tahoe; 49 botanical specimens from northern California. Gift.

Kennedy, E. H., 1369 Sacramento Street, San Francisco: One *Pelecanus californicus,* in flesh, from San Francisco. Gift.

Kerr, Mrs. Thomas F., 949 14th Street, Pacific Grove, Calif.: Two specimens of plants. Gift.

Kidder, Mrs. Anna, Berkeley, Calif.: Three specimens of plants from Shasta County, Calif. Gift.

Klauber, L. M., San Diego, Calif.: One snake from Lower California; 1 snake from San Diego County, Calif. Gift.

Knight, L., Inverness, Calif.: One salamander from Marin County, Calif. Gift.

Lastreto, C. B., 260 California Street, San Francisco: California Academy of Sciences Proceedings, Vol. X, Index, Vol. XI Annual Report, Vol. XII, No. 7-23 and 30, Vol. XIII, No. 1-4, 6-11, 2 copies each of 12 and 13 and 14. Damager copies Vol. XIII, No. 7-11; Eradication of Farm Weeds by Sulphate of Iron. Gift.

Loomis, Leverett Mills, Sutter Street, San Francisco: One Valley Quail *(Lophortyx californica californica),* in flesh, from Golden Gate Park, San Francisco. Gift.

Macomber, A. K., Burlingame, Calif.: One mounted specimen of Gorilla *(Gorilla gorilla beringeri)* from Belgian Congo, Africa. Indefinite loan.

Mailliard, John Ward, 2230 Green Street, San Francisco: Nest and eggs of California Creeper *(Certhia familiaris occidentalis)*, from Mendocino County, Calif. Gift.

Mailliard, Joseph, California Academy of Sciences, San Francisco: 26 bird skins from Tehama County, Calif.; 13 bird and 11 mammal skins from Marin County, Calif.; 1 box of accessories for groups; 9 mammals in flesh, from Marin County, and 82 bird and 21 mammal skins from Modoc County, Calif.; 119 bird skins and 39 mammal skins and skulls from Modoc County, Calif; nesting hole of California Woodpecker and other accessories; 60 mammal skins from Modoc County, and 18 mammal skins and skulls from Tehama and Modoc counties, 41 mammal skins and 34 skulls from Modoc County, and 6 mammal skins from Tehama and Modoc counties, Calif.; 39 bird skins from Tehama and Modoc counties, 34 bird skins and fragments of shells from crane's nest, and Nevada Redwing, 1/3n, from Modoc County, Calif.; 48 bird skins and 1 set of eggs from Modoc County, Calif.; 33 mammal skins and skulls, 3 mammal skins and 1 bird skin from Tehama County, Calif.; 7 specimens of mammals and 6 specimens of birds from Marin County, Calif.; 141 bird skins and 102 mammal skins and 1 skull of Desert Bighorn *(Ovis canadensis nelsoni)*, from Riverside County, Calif. Exploration.

28 sets of eggs from California, South Dakota, Connecticut, New York and Vermont. Gift.

Mailliard, Thomas P., San Francisco, Calif.: 1 *Strix occidentalis caurina*, in flesh, from Mendocino County, Calif. Gift.

Malloch, John, California Academy of Sciences, San Francisco: 1 *Microtus californicus californicus*, from Golden Gate Park, San Francisco. Gift.

Martin, W. J., Steinhart Aquarium, San Francisco: 1 large mass of salt crystals (Sodium chloride) from Moss Landing, Monterey County, Calif.; 1 set of *Tyto alba pratincola*, from San Joaquin County, Calif. Gift. 1 (Indian) flesher, Derby Dam, Nevada. Gift. 1 mortar and pestle found 4 miles north of Grayson, California, on the shore of the San Joaquin River. Exploration.

McAllister, M. Hall, 485 California Street, San Francisco: 1 calendar (1901) Transportation; 1 calendar (1900) Catlin Indian paintings; 1 picture of Buffalo Bill. Gift.

McIntosh, Mrs. W. C., San Francisco, Calif.: 1 tortoise. Gift.

McLaren, John, Golden Gate Park, San Francisco: 1 skull of *Alces* sp., 1 *Aix sponsa*, in flesh, 1 *Cervus axis*, fawn, in flesh, and 1 *Sciurus niger rufiventris*, in flesh, from Golden Gate Park, San Francisco. Gift.

Meiere, Mrs. Ernest, Los Altos, Calif.: 2 specimens of cultivated plants. Gift.

Mertens, Dr. Robert, Frankfort-a-Main, Germany: 18 frogs from Africa, East and West Indies. Exchange.

Michaels, Mrs. Enid, Yosemite, Calif.: 3 specimens of plants, Yosemite. Gift.

Missouri Botanical Gardens, St. Louis, Missouri: 192 specimens of North American plants. Exchange.

Morrice, Charles, Bakersfield, Calif.: 6 rattlesnake rattles; 27 lots of vertebrate fossils, 83 specimens of bones and teeth of marine vertebrates from Shark Tooth Mountain, Kern County, Calif. Gift.

Morris, Mrs. Will, 879 Turk Street, San Francisco: 1 canary. Gift.

Murray, George K., Hotel Kinnard, Cleveland, Ohio: "The Irish Wolfdog" by Edmund Hogan. Gift.

Musee Zoologique de L'Academie des Sciences de Russie, Petrograd, Russia: 3 *Salamandra caucasica;* 3 *Molge vittata;* 2 *Salamandra keyserlingii;* 2 *Ranidens sibericus;* 1 *Pelodutes caucasucus;* 3 *Bufo raddei;* 1 *Hyla stepheni;* 1 *Rana amurensis;* 3 *Rana macrocnemis;* 1 *Rana avarlis altaica.* Exchange.

Oldroyd, Mrs. I. S., Stanford University, Calif.: Henry Hemphill Catalogue of North American Shells. Gift.

Orpet, E. O., Santa Barbara City Hall, Santa Barbara, Calif.: 3 botanical specimens from Santa Barbara, Calif. Gift.

Pacific Oil Company, San Francisco, through Charles Morrice: 150 shark teeth, 5 sea lion teeth, 5 sea cow teeth, 30 sting ray stings, 6 fish bones, bird bones, and other animal bones, all fossil; 4 boxes (about 150 pieces) of fossil mammalian bones, largely whales, from Shark Tooth Mountain, Kern County, Calif.; 4 boxes of marine and terrestial mammalian bones from Kern County Miocene; 4 boxes (about 400 pieces) of fossil bones from Shark Tooth Mound, Kern County, Calif; 1 lot of Pleistocene mollusks from Baldwin Hills, Calif. Gift.

Painton, Dr. Harry R., 4601 Mission Street, San Francisco: 43 bird skins: 386 sets of eggs (1160 eggs); and 36 nests, principally Californian. Gift.

Peacock, Mary A., Crescent City, Calif.: 1 botanical specimen from Del Norte County, Calif. Gift.

Peers, Miss Susie M., California Academy of Sciences, San Francisco: current issues of "Science." Gift.

Pell, Mrs., Forest Ave., Pacific Grove, Calif.: 1 cultivated plant. Gift.

Philadelphia Academy of Natural Sciences, Philadelphia, Penn.: 2 specimens of freshwater shells from Siskiyou County, Calif., part of type lot. Gift.

Phillips, Mr., Park Game Warden, Golden Gate Park, San Francisco: 1 *Mustela xanthogyenys munda,* in flesh, and 1 *Epimys norvegicus,* in flesh, from Golden Gate Park. Gift.

Purdy, Carl, Ukiah, Calif.: 3 botanical specimens from Oregon. Gift.

Reagan, Albert B.: 44 specimens of *Lymnæa stagnalis appressa* Say, fossil, from White Cone, 45 miles north of Holbrook, Ariz. Gift.

Rixford, G. P., San Francisco: 1 botanical specimen from Placerville, Calif. Gift.

Rodda, Mrs. A. F., 2616 Sacramento Street, San Francisco: 2 specimens of plants from Marin County, Calif. Gift.

Russ, R. A., Olympic Club, San Francisco, through W. J. Martin: 12 crystals of salt from salt mine at Berchtersgaden, Russia. Gift.

Russell, C. P., Yosemite Museum, Yosemite, Calif: 3 *Ochotona schisticeps muiri* and 3 *Citellus beldingii,* from Tuolumne Meadows, Calif: 2 lizards from Yosemite Valley. Gift.

Sandhouse, Miss Grace, University of Colorado, Boulder, Colorado: 32 bees, duplicates from our collections of Western Osmias. Exchange.

Sawyer, C. H., 265 City Hall, San Francisco: 1 *Tragopan caboti,* in flesh, from China. Gift.

Sheppard, Louis, Young Men's Christian Association, San Francisco: Operculum of *Turbo marmoratus,* from Honolulu. Gift.

Schenck, M., Stanford University, Calif.: 1 lot of freshwater fossils from California. Gift.

Smith, Chandler, 149 Palm Ave., San Francisco: 1 *Colaptes cafer collaris,* in flesh, and 5 *Melospiza melodia pusillula,* from San Mateo County, Calif. Gift.

Stacey, J. W., Flood Building, San Francisco: 2 botanical specimens. Gift.

Stanford University, California: 2 snakes from Lower California, Mexico. Gift.

Steinbeck, J. W., 611 Bristol Avenue, Stockton, Calif.: 1 *Columba fasciata fasciata,* in flesh, from San Joaquin County, Calif. Gift.

Steinbeck, W. P., 1029 W. Hunter Street, Stockton, Calif.: 57 botanical specimens from Tuolumne County, Calif. Gift.

Steinhart Aquarium, San Francisco: 1 turtle and 4 frogs from Lake Maxinkuckee, Indiana: 2 skulls of *Callorhinus alascanus,* from Pribilof Islands, Alaska; 2 salamanders from California; 2 *Phoca richardi geronimensis,* in flesh, from San Francisco. Gift.

Stockel, C. B., Columbia, Tuolumne County, Calif.: 1 hornets' nest, *Vespa maculata.* Gift.

Storer, Prof. Tracy I., Davis, Calif.: Occasional Papers of the California Academy of Sciences, Vol. 6, 2 copies; California Fish and Game, 2 excerpts. Gift.

Stowell, Dr. J. M., 632 Haight Street, San Francisco: 1 *Mergus americanus,* in flesh, from Colusa County, Calif. Gift.

Sutliffe, Mrs. E. C., 700 Lake Street, San Francisco: 3 botanical specimens from Marin County, Calif. Gift.

Sweden (World's Fair Exhibit): 100 sheets of sulphite wrapping paper; 100 sheets colored writing paper; 100 sheets white bank paper; 100 sheets tissue paper. Gift.

Tilbury, Miss Ruth, 62 Concord Street, San Francisco: 1 mounted specimen of Spitz dog. Gift.

Tose, Frank, California Academy of Sciences, San Francisco: 5 *Lobipes lobatus* and 1 *Colymbus nigricollis californicus,* from San Mateo County, Calif. Gift.

Unsworth, Mrs. J. A., 8 Le Roy Place, San Francisco: 1 botanical specimen from San Mateo County, Calif. Gift.

Van Denburgh, Douglas, Los Gatos, Calif.: 1311 sets (4667 eggs) and 16 nests of birds, mainly from California. The John Van Denburgh collection. Gift.

Van Denburgh, Dr. John, San Francisco: One skull of *Tyto alba pratincola* from San Benito County, Calif.; about 1000 specimens, 250 (estimated) species, of marine mollusks and other invertebrates, including 2 orange coweries and 32 other species. Gift.

Van Duzee, E. P., California Academy of Sciences, San Francisco: 1 snake in alcohol, from Marin County, California. Gift.

Van Dyke, Dr. Edwin Cooper, Berkeley, Calif: 450 land and freshwater shells from China. Gift.

Wallace, A. D., Camp No. 2, Sugar Pine, Calif: 16 butterflies. Gift.

Walther, Eric, Golden Gate Park, San Francisco: 163 specimens of exotic plants from Golden Gate Park; 36 botanical specimens from Bay region. Gift.

Werdemann, Dr. E., Santiago, Chile: 300 botanical specimens from Chile. Purchase.

Wilder, Mrs. H. C., Carlotta, Humboldt County, Calif.: 7 botanical specimens. Gift.

Wilkens, Mrs. Johanna, California Academy of Sciences, San Francisco: 1 *Spinus pinus,* in flesh, from Golden Gate Park, San Francisco. Gift.

Woodcock, Miss Fidelia, Balboa Park, San Diego, Calif.: One specimen of exotic plant. Gift.

Wright, Elizabeth, Calistoga: One botanical specimen from Mono Lake. Gift.

FINANCIAL STATEMENTS

REPORT OF THE TREASURER

For the nine-months' period ending December 31, 1924

April 1, 1924, Balance due Crocker National Bank..........$ 3,897.97

Receipts:

Dues	$ 798.25	
Charles Crocker Scientific Fund Endowment Income	1,268.60	
James Lick Endowment Income	51,055.12	
General Income	13,220.97	
John W. Hendrie Endowment Income	675.00	
Publications	171.55	
Interest	377.44	
Ignatz Steinhart Trust Interest	502.05	
U. S. Treasury Certificates	3,000.00	
Bills Receivable, Ignatz Steinhart Trust	3,000.00	
W. G. Wright Fund	10.00	
Post Card Sales	950.92	
Wild Life Protection Fund	133.33	
Henry M. Holbrook Fund	2,000.00	
Sundry Accounts	705.02	
		$77,868.25
		$73,970.28

REPORT OF THE TREASURER—Continued

Expenditures:

Interest	$10,390.85	
Contingent Fund	304.14	
Salary Expense General	13,448.73	
Museum Department Appropriations	7,775.02	
Museum Department Salaries	9,330.00	
Publications	2,287.79	
Library	1,210.85	
Steinhart Aquarium Equipment	1,620.88	
Steinhart Aquarium Construction	74.60	
Sundry Creditors	10,105.05	
Expense	3,324.76	
Wild Life Protection Fund	89.91	
Notes Payable	10,000.00	
Insurance	426.09	
Grizzly Bear Group	28.47	
Holbrook Installation	178.53	
		$70,595.67
December 31, 1924, Balance with Crocker National Bank		$ 3,374.61

M. Hall McAllister, *Treasurer.*

Examined and found correct,
McLaren, Goode & Co., *Certified Public Accountants.*
San Francisco, California, February 13, 1925.

INCOME AND OPERATING EXPENSES

For the period ending December 31, 1924

Income:		
Charles Crocker Scientific Fund Endowment Income		$ 1,268.60
James Lick Endowment Income		51,055.12
General Income		13,220.97
Dues		898.25
Interest from Temporary Investments		377.44
Profit on Post Card Sales		469.97
Total Income		$67,290.35
Expenditures:		
General Expense	$ 3,211.03	
Salaries	23,204.83	
Interest on Mortgage	10,390.85	
Insurance	427.69	
Total Expenditures		$37,234.40
Net Income Transferred to Surplus Account		$30,055.95

SUMMARY OF SURPLUS ACCOUNT

December 31, 1924

Balance April 1, 1924		$415,648.63
Additions:		
Net Income for the nine months ended December 31, 1924		30,055.95
		$445,704.58
Deductions:		
Depreciation:		
Office Furniture	$ 206.90	
Commercial Building	7,752.27	
Museum Building	2,880.38	
Storage Cases	176.64	
Tools and Equipment	318.18	
		$ 11,334.37
Surplus, December 31, 1924		$434,370.21

IGNATZ STEINHART TRUST

December 31, 1924

Amount of Fund:		
Bequest from the Ignatz Steinhart Estate..		$250,000.00
Interest on Temporary Investments......		55,477.70
		$305,477.70
Disposition of Fund:		
Steinhart Aquarium Construction.........	$263,390.29	
Steinhart Aquarium Equipment...........	23,713.33	
Temporary Investments:		
Bills Receivable......................	13,000.00	
Revolving Fund......................	5,000.00	
Uninvested Cash on hand................	374.08	
		$305,477.70

BALANCE SHEET

December 31, 1924

Assets

Property:		
Real Estate, 831-833 Market Street	$600,000.00	
Real Estate, Jessie Street	8,083.65	
Commercial Building, 831-833 Market St.	516,818.66	
		$1,124,902.31
Museum, Golden Gate Park:		
Construction	192,025.92	
General Collections	144,178.73	
Library and Equipment	84,480.14	
Tools and Equipment	30,713.05	
Office Furniture	3,940.96	
		$ 455,338.80
Investment Securities		17,700.00
Ignatz Steinhart Trust:		
Bills Receivable	$ 13,000.00	
Steinhart Aquarium Construction	263,390.29	
Steinhart Aquarium Equipment	23,713.33	
Steinhart Aquarium Revolving Fund	5,000.00	
Uninvested cash on hand	374.08	
		$ 305,477.70
Current Assets:		
Cash in bank and on hand	$ 3,150.73	
Bills Receivable	5,000.00	
Sundry Accounts	127.50	
Post Cards in Stock (for sale)	1,252.10	
Foreign Exchange	36.84	
		$ 9,567.17
		$1,912,985.98

BALANCE SHEET—Continued

Liabilities

Endowments:		
James Lick Endowment	$804,902.31	
Charles Crocker Scientific Fund Endowment	20,000.00	
John W. Hendrie Endowment	13,600.00	
		$ 838,502.31
Ignatz Steinhart Trust:		
Ignatz Steinhart Trust	$250,000.00	
Ignatz Steinhart Trust Interest	55,477.70	
		$ 305,477.70
Alvord Bequest, Botanical		5,000.00
John W. Hendrie Endowment Income		3,375.00
W. G. Wright Fund		123.20
Wild Life Protection Fund		185.22
Ducks of the World Fund		100.00
Holbrook Fund		1,821.47
Reserve for Depreciation		71,171.71
Bills Payable		250,000.00
Sundry Creditors		2,859.16
Surplus		434,370.21
Total		$1,912,985.98

Susie M. Peers,
Assistant Acting Secretary,
Board of Trustees.

We have examined the foregoing Balance Sheet, together with the books and accounts of the California Academy of Sciences, and, in our opinion, it is properly drawn up so as to exhibit a true and correct view of the Academy's affairs, as shown by the books.

McLaren, Goode & Co.,
Certified Public Accountants.

San Francisco, California,
February 13, 1925.

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BY

JOSEPH GRINNELL

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OPISTHOBRANCHIATE MOLLUSCA

BY
FRANK M. MACFARLAND
Department of Anatomy
Stanford University, California

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